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**Ohishi et al.**

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(54) **INFORMATION PROCESSING APPARATUS FOR CONTROLLING CONTROL FLOW, INFORMATION PROCESSING SYSTEM FOR CONTROLLING CONTROL FLOW, AND METHOD FOR CONTROLLING DEVICE**

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**G05B 15/02** (2006.01)

(52) **U.S. Cl.**  
CPC ..... **G05B 15/02** (2013.01)

(58) **Field of Classification Search**  
CPC ..... G05B 15/02  
See application file for complete search history.

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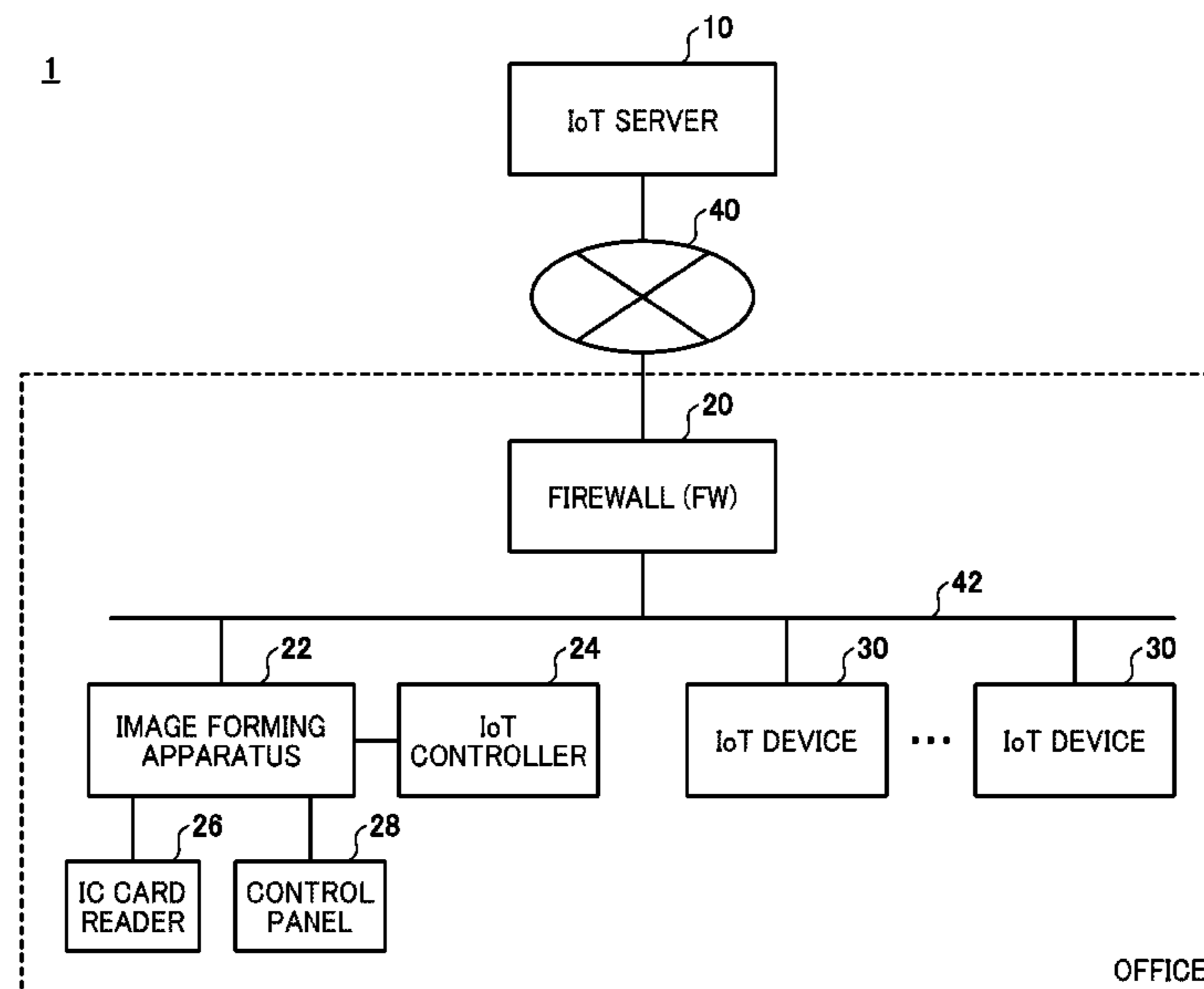
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(57) **ABSTRACT**

An information processing apparatus controls one or more processes of one or more devices belonging to a group based on data transmitted through a network from one or more devices belonging to the same group. The apparatus includes a memory and circuitry. The memory stores, on a group-by-group basis, policy data and a control flow. The circuitry makes the control flow effective, in a case in which at least one process to be executed when at least one condition is satisfied is permitted or is not prohibited to a user from whom a request for execution of the control flow is accepted, according to the policy data. The circuitry controls the at least one process of the at least one device according to the control flow that is made effective, on a group-by-group basis.

**19 Claims, 13 Drawing Sheets**



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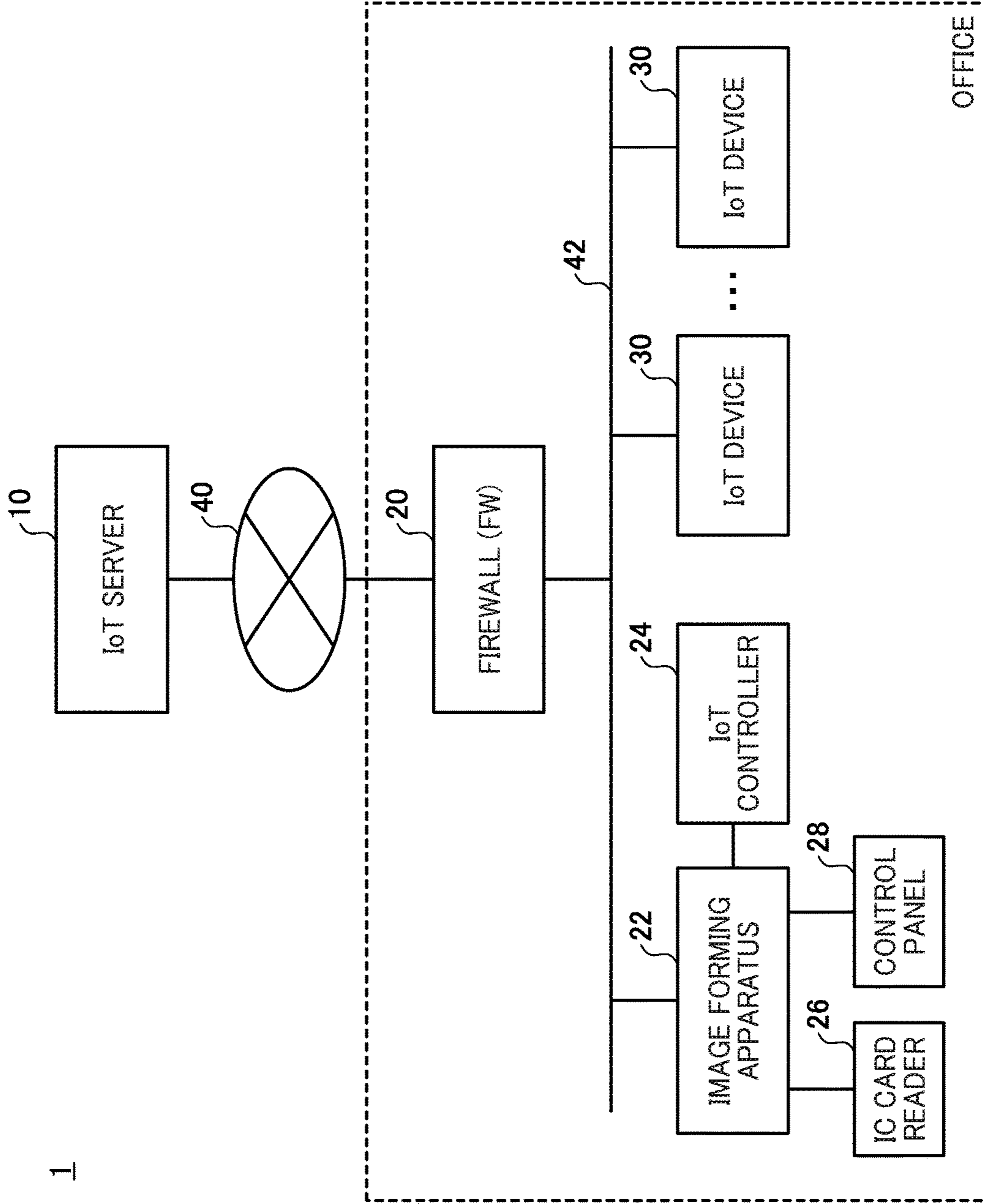
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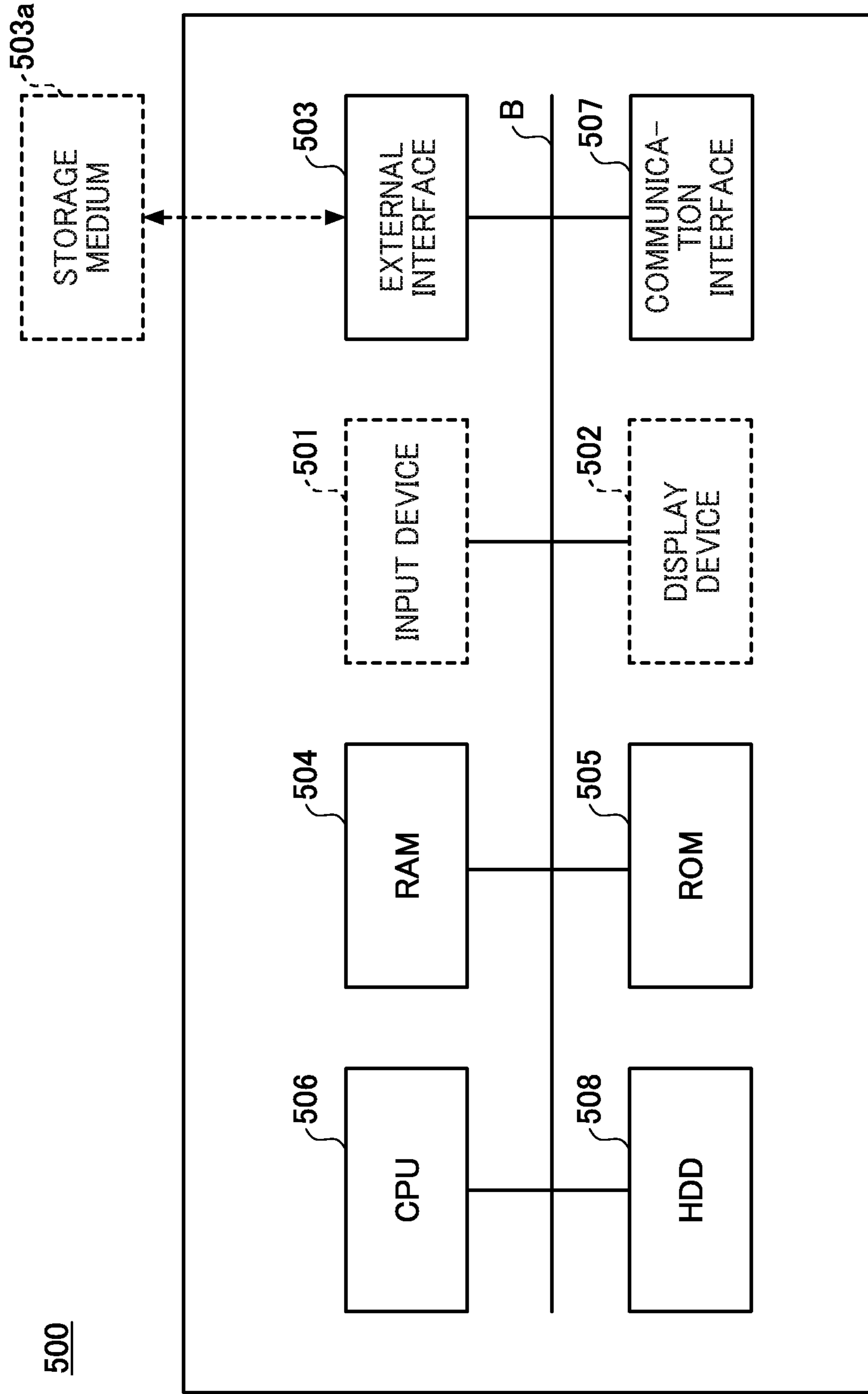
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FIG. 1



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FIG. 2



500

FIG. 3

22

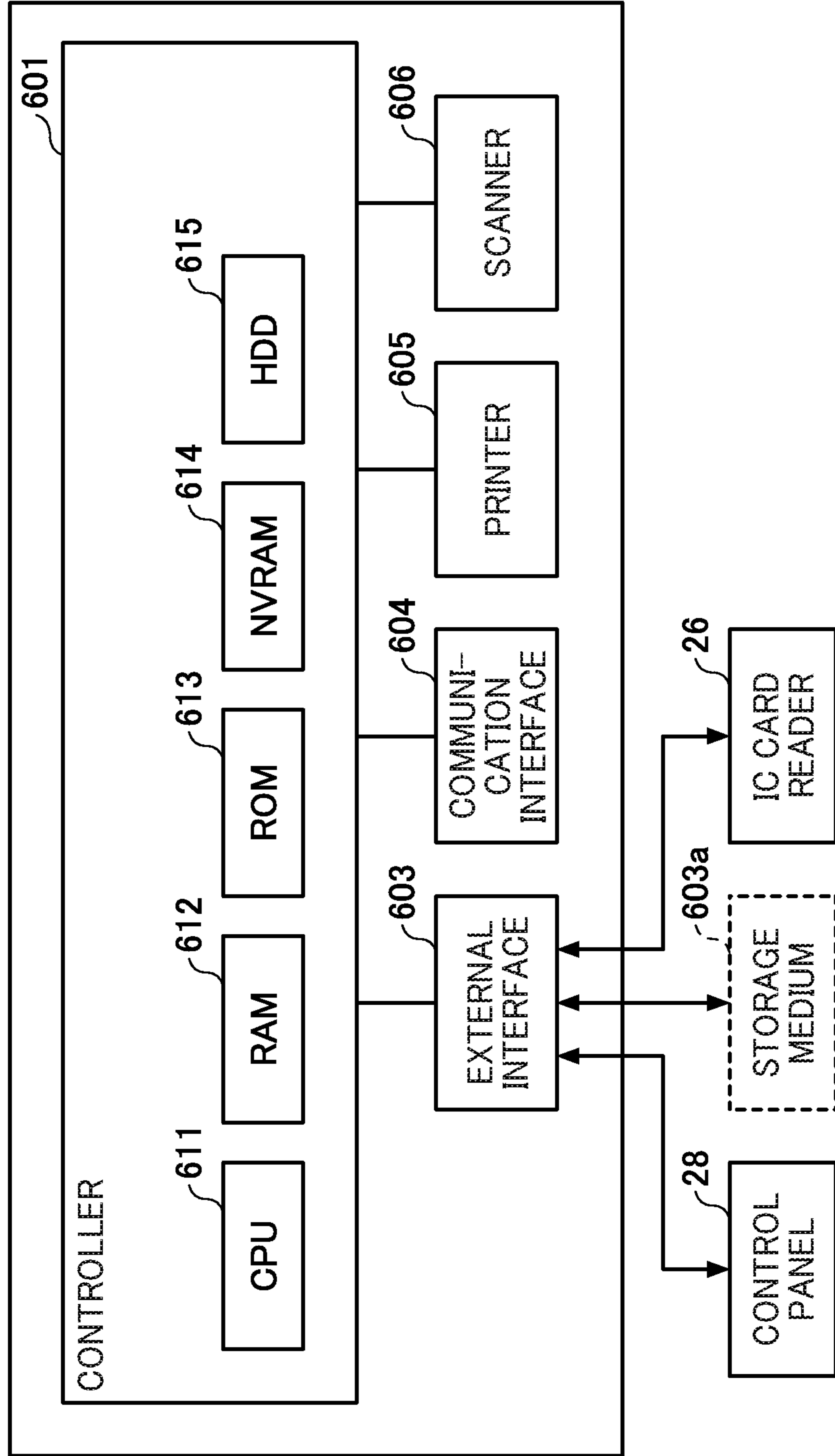


FIG. 4

24

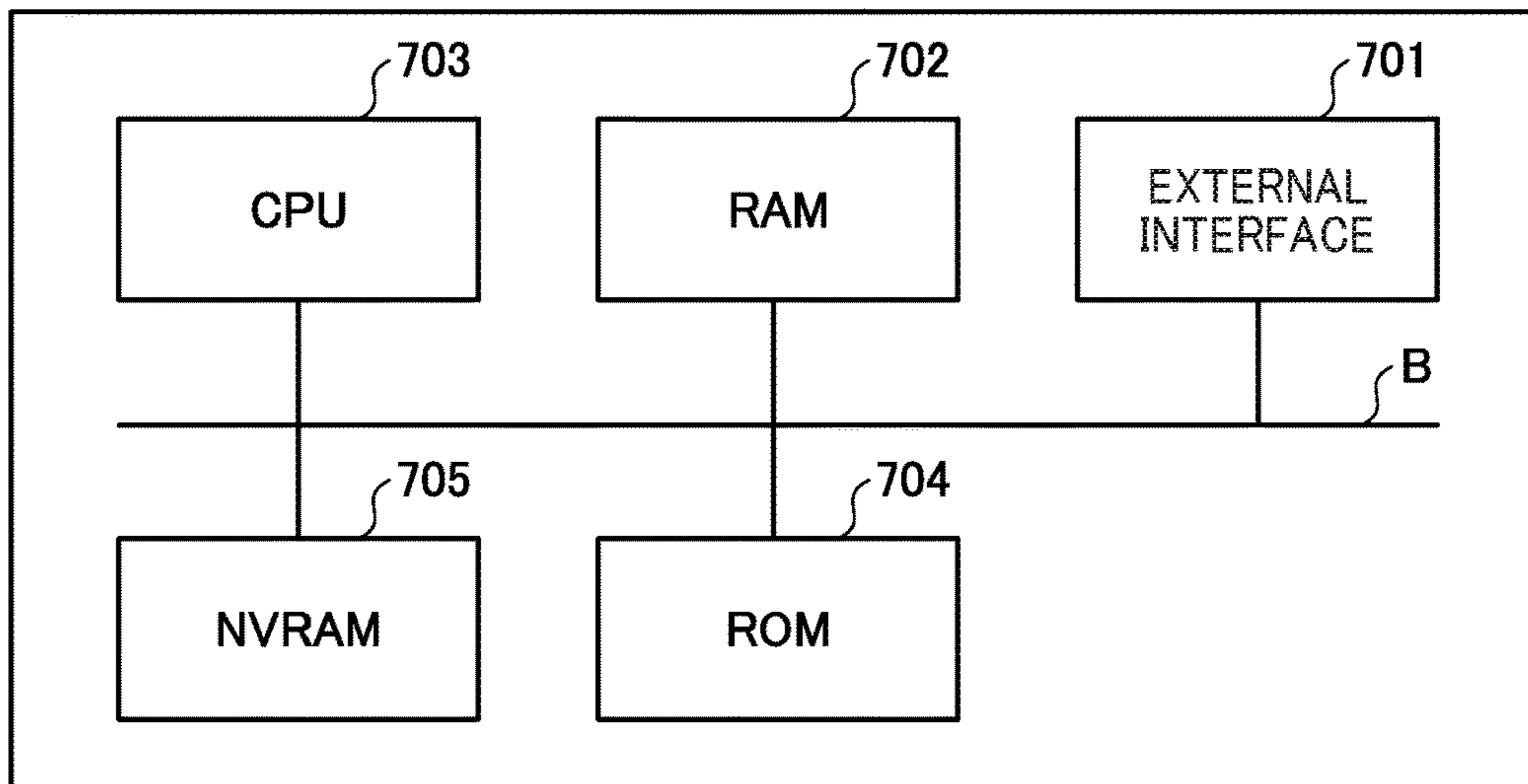


FIG. 5

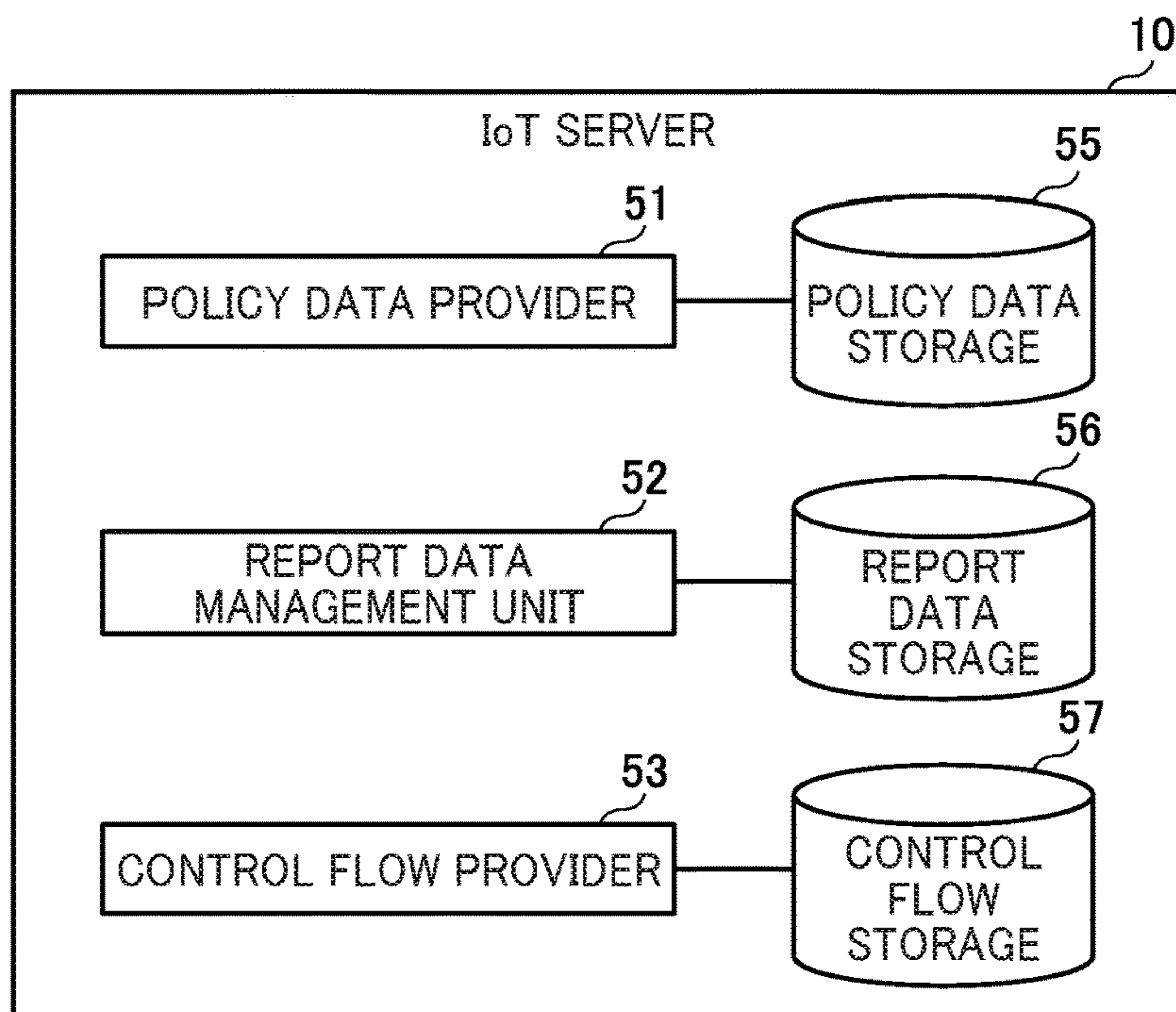




FIG. 6

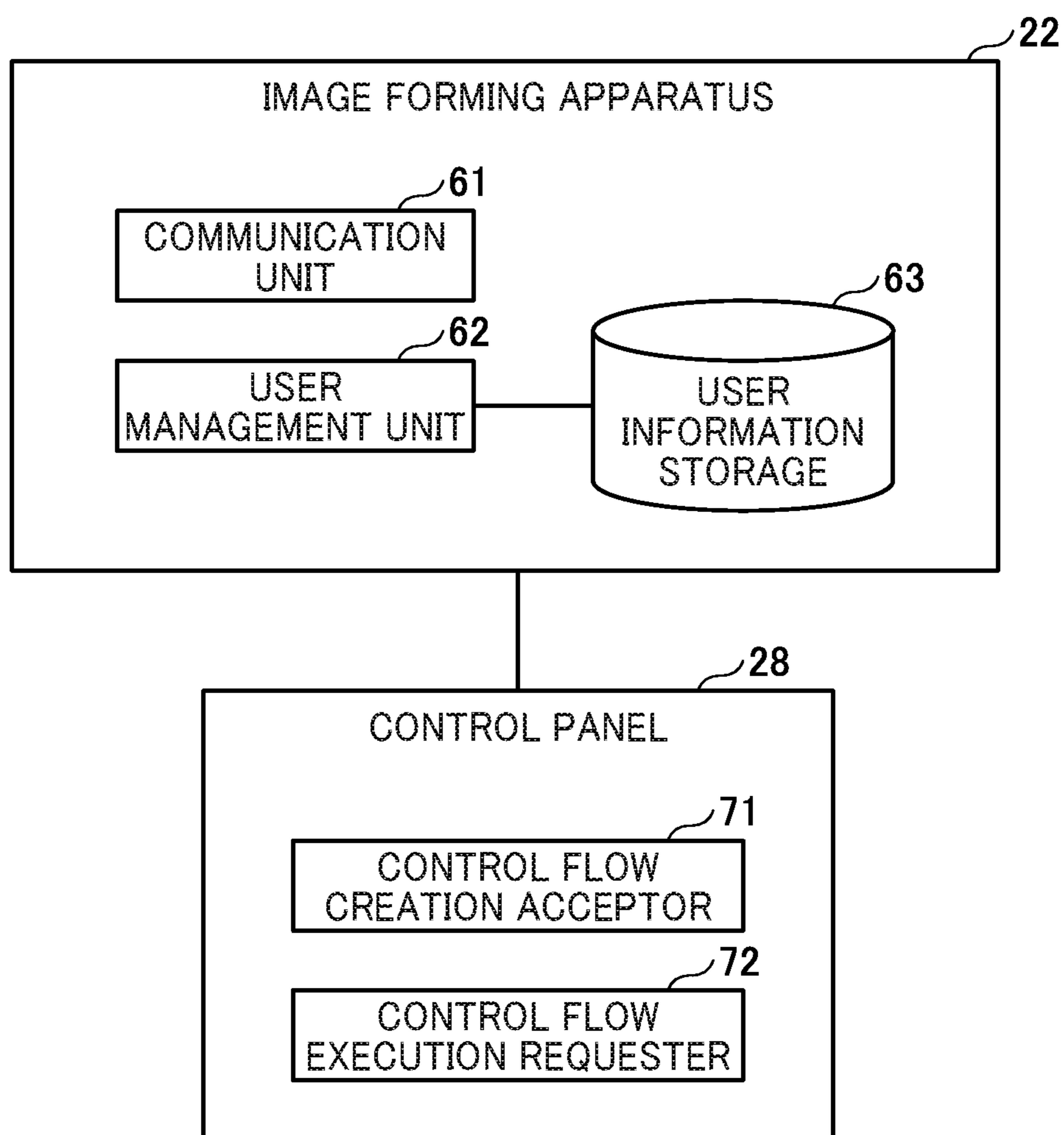


FIG. 7

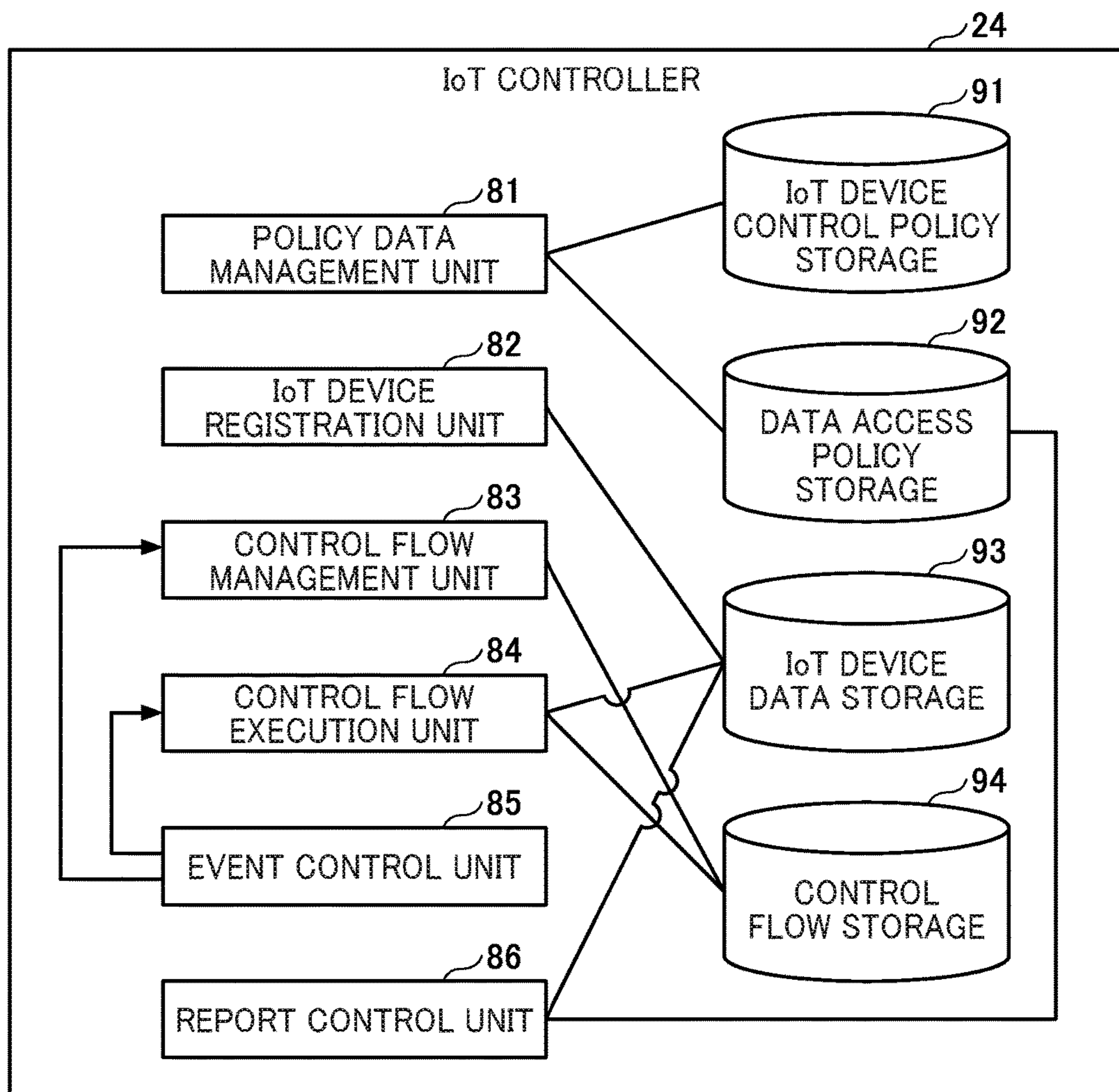


FIG. 8

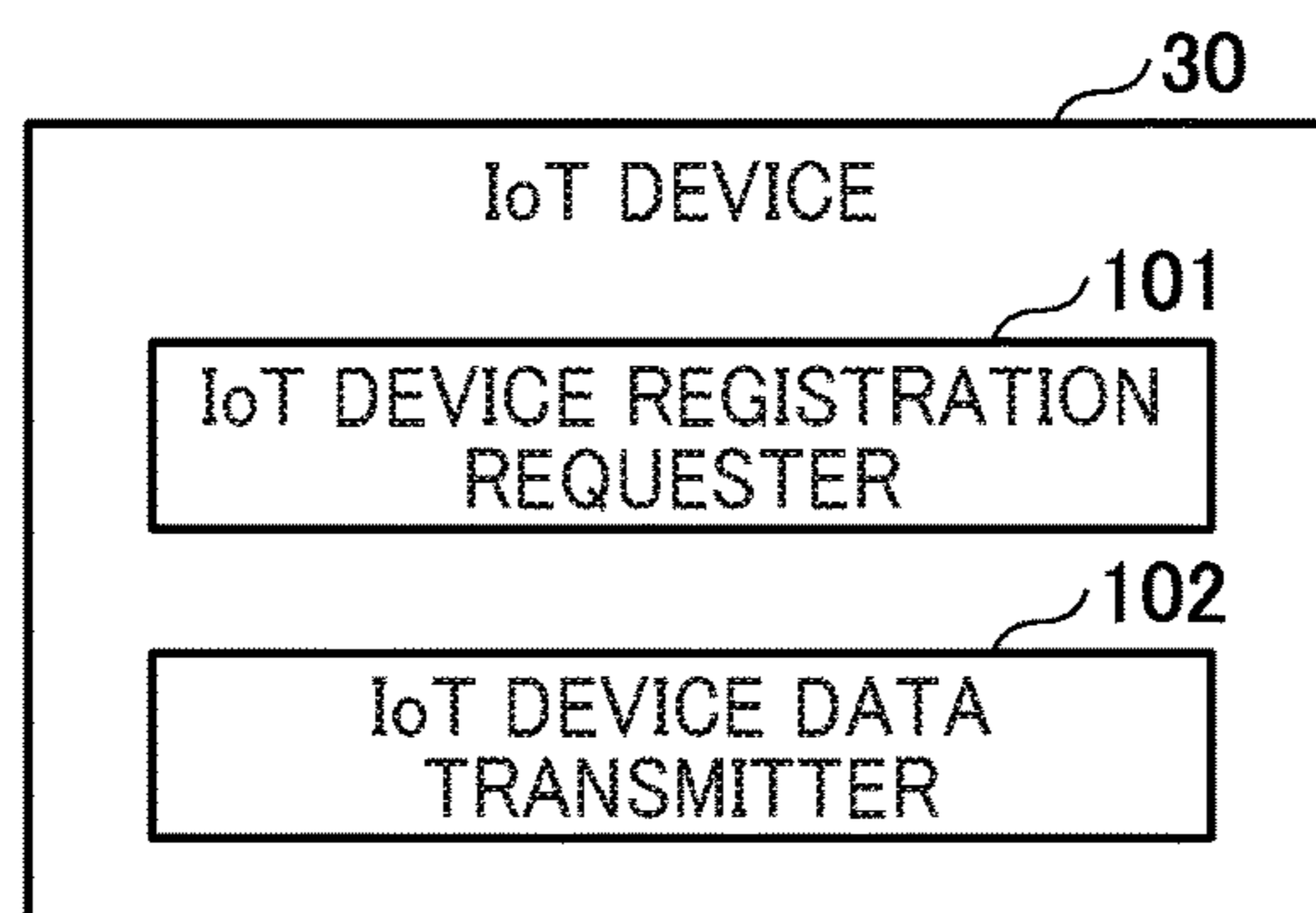




FIG. 9

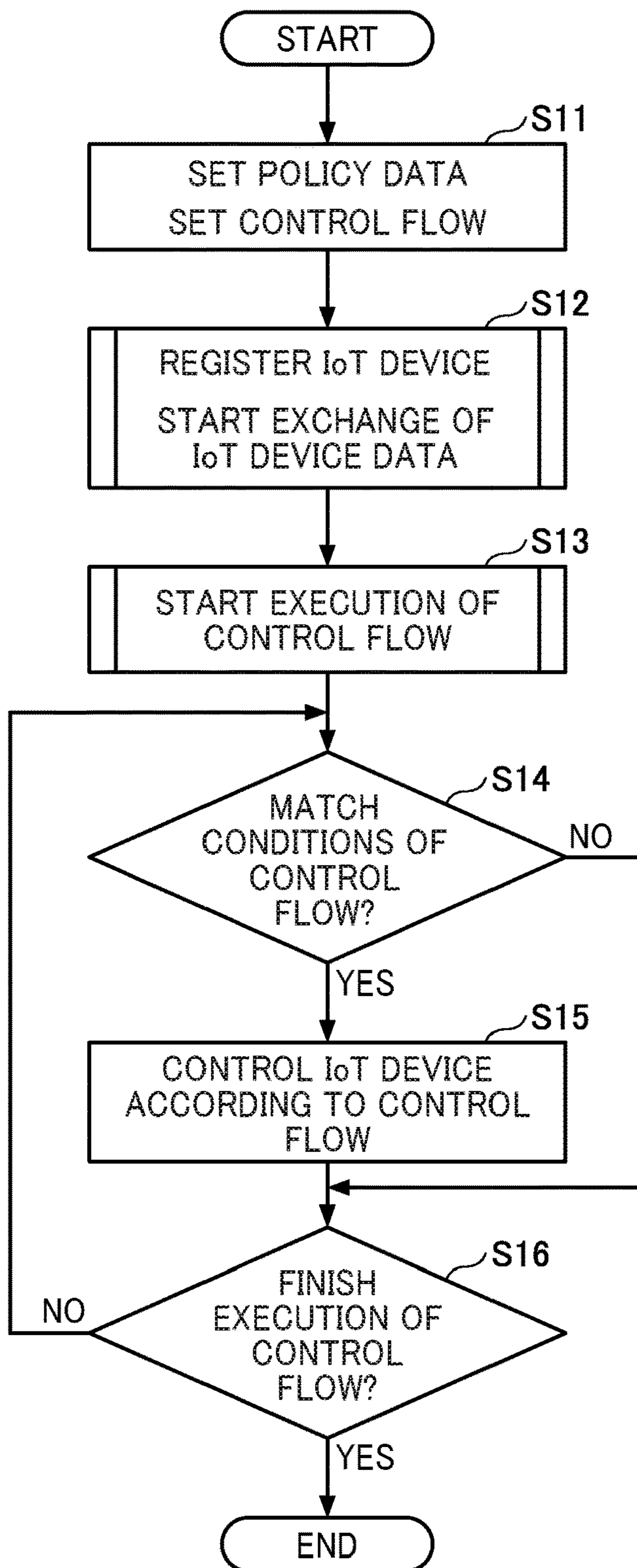


FIG. 10

NAME OF CONTROL FLOW	CONDITION		PROCESS	
	8 TO 20 O' CLOCK ON WEEKDAYS	TEMPERATURE SENSOR 28°C OR HIGHER	TURN ON AIR CONDITIONER	SET TEMPERATURE TO 25°C
AIR CONDITIONER CONTROL	8 TO 20 O' CLOCK ON WEEKDAYS	TEMPERATURE SENSOR 28°C OR HIGHER	TURN ON AIR CONDITIONER	SET TEMPERATURE TO 25°C
AIR CONDITIONER CONTROL	8 TO 20 O' CLOCK ON WEEKDAYS	TEMPERATURE SENSOR 22°C OR LOWER	TURN ON AIR CONDITIONER	SET TEMPERATURE TO 25°C

FIG. 11

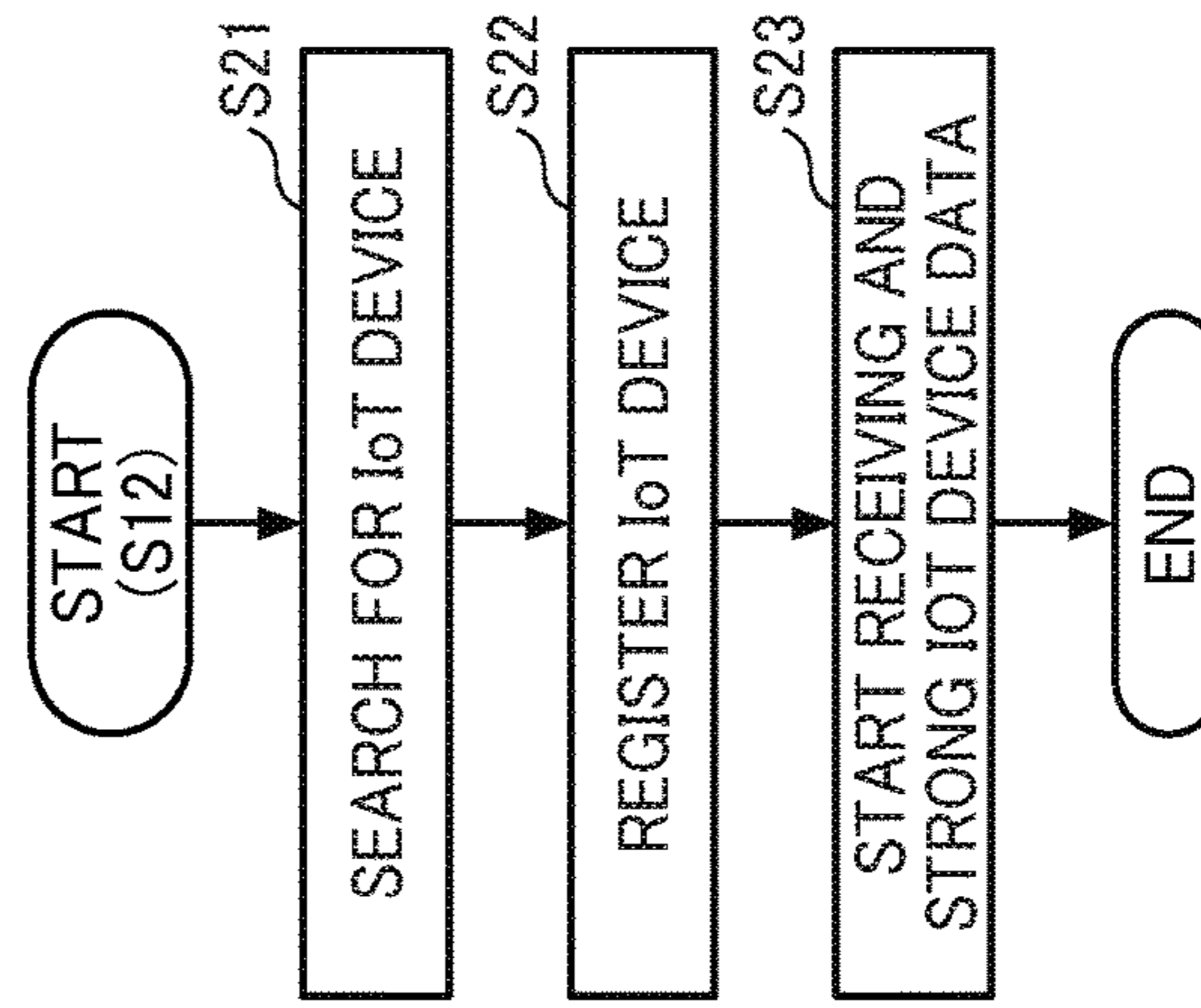


FIG. 12

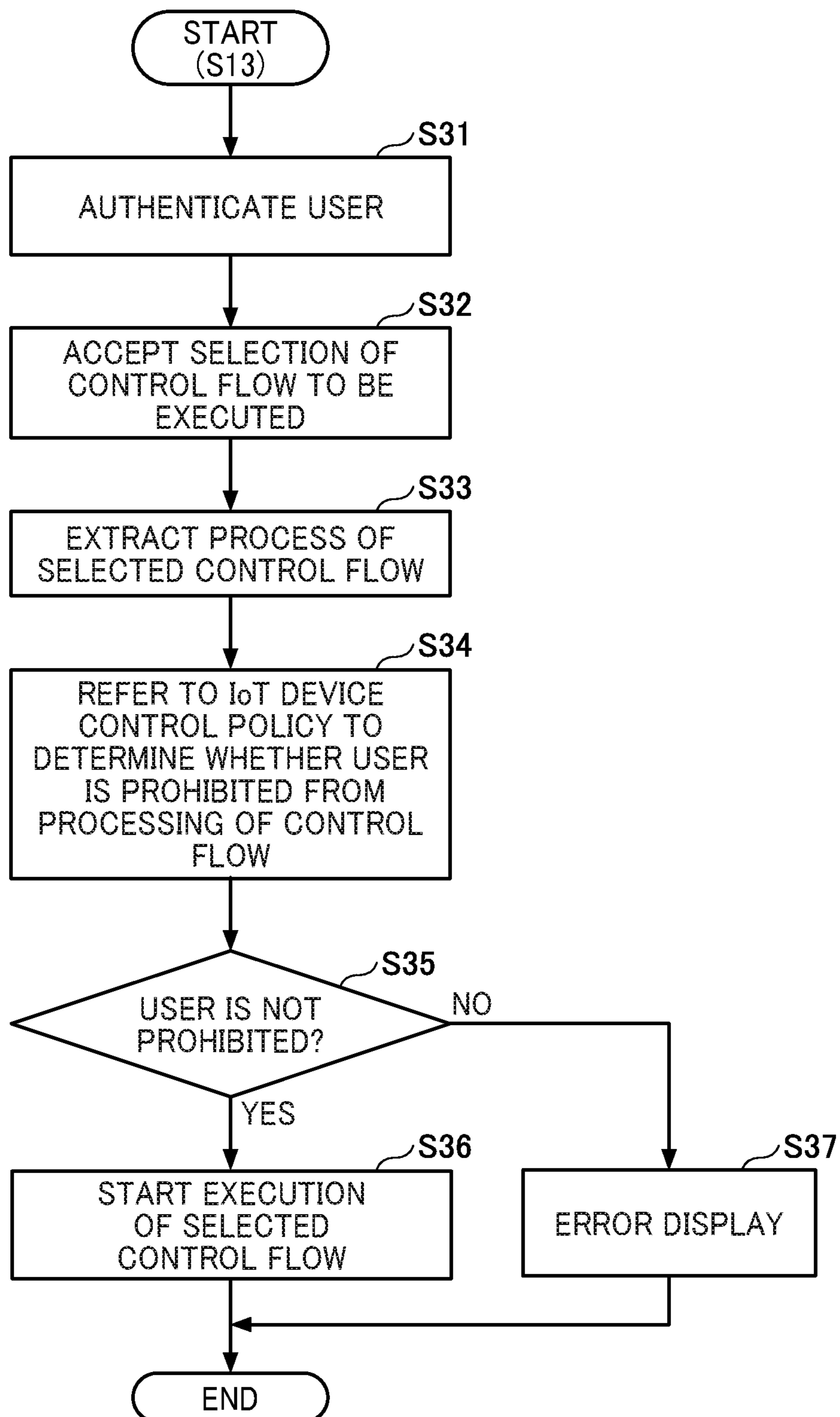


FIG. 13

IoT DEVICE CONTROL POLICY

NAME OF IoT DEVICE	ROLE	PROCESS	PROCESS
AIR CONDITIONER	ADMINISTRATIVE USER	POWER ON/OFF PERMITTED	TEMPERATURE SETTING PERMITTED
AIR CONDITIONER	GENERAL USER	POWER ON/OFF PROHIBITED	TEMPERATURE SETTING PROHIBITED
TEMPERATURE SENSOR	ALL	TEMPERATURE READ-OUT PERMITTED	...



FIG. 14

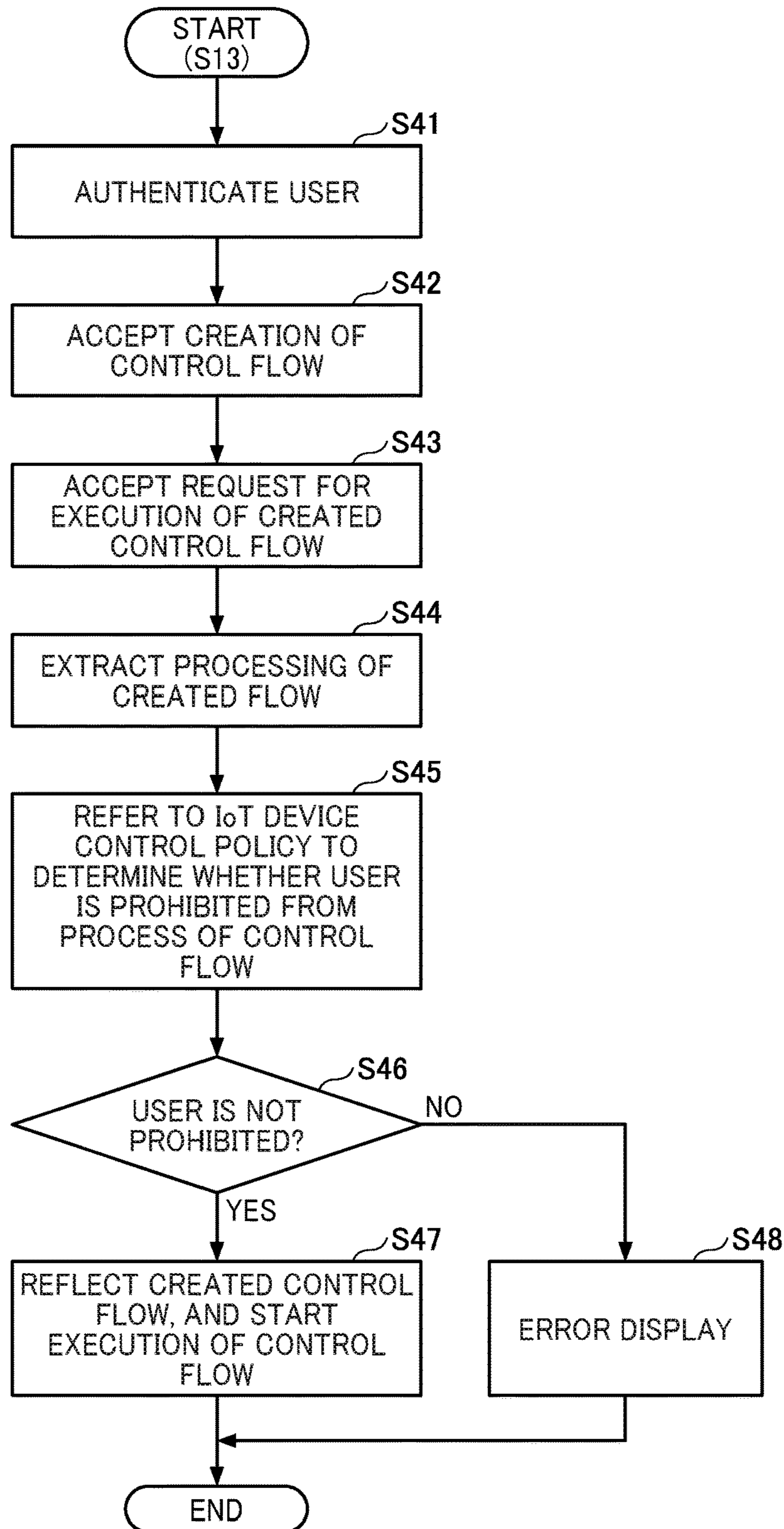




FIG. 15

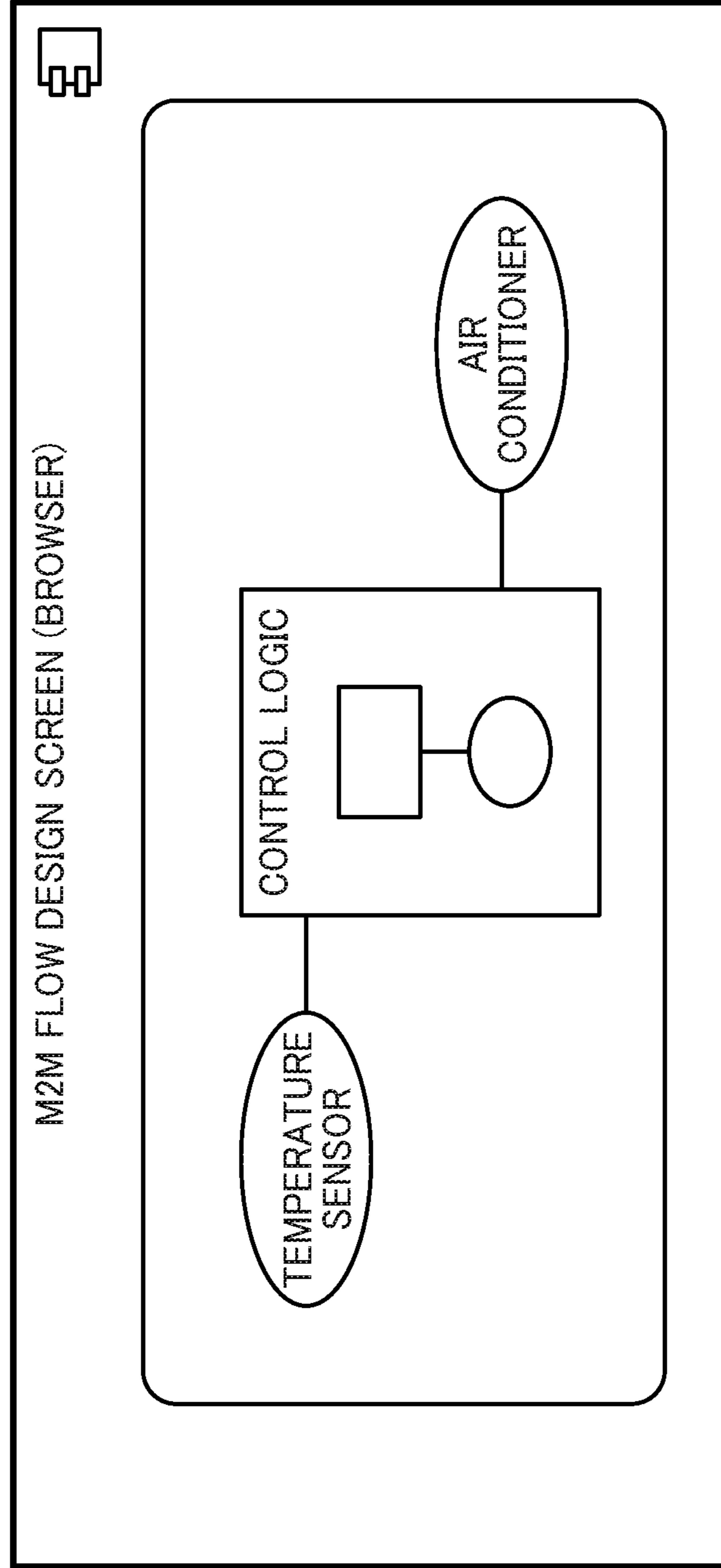
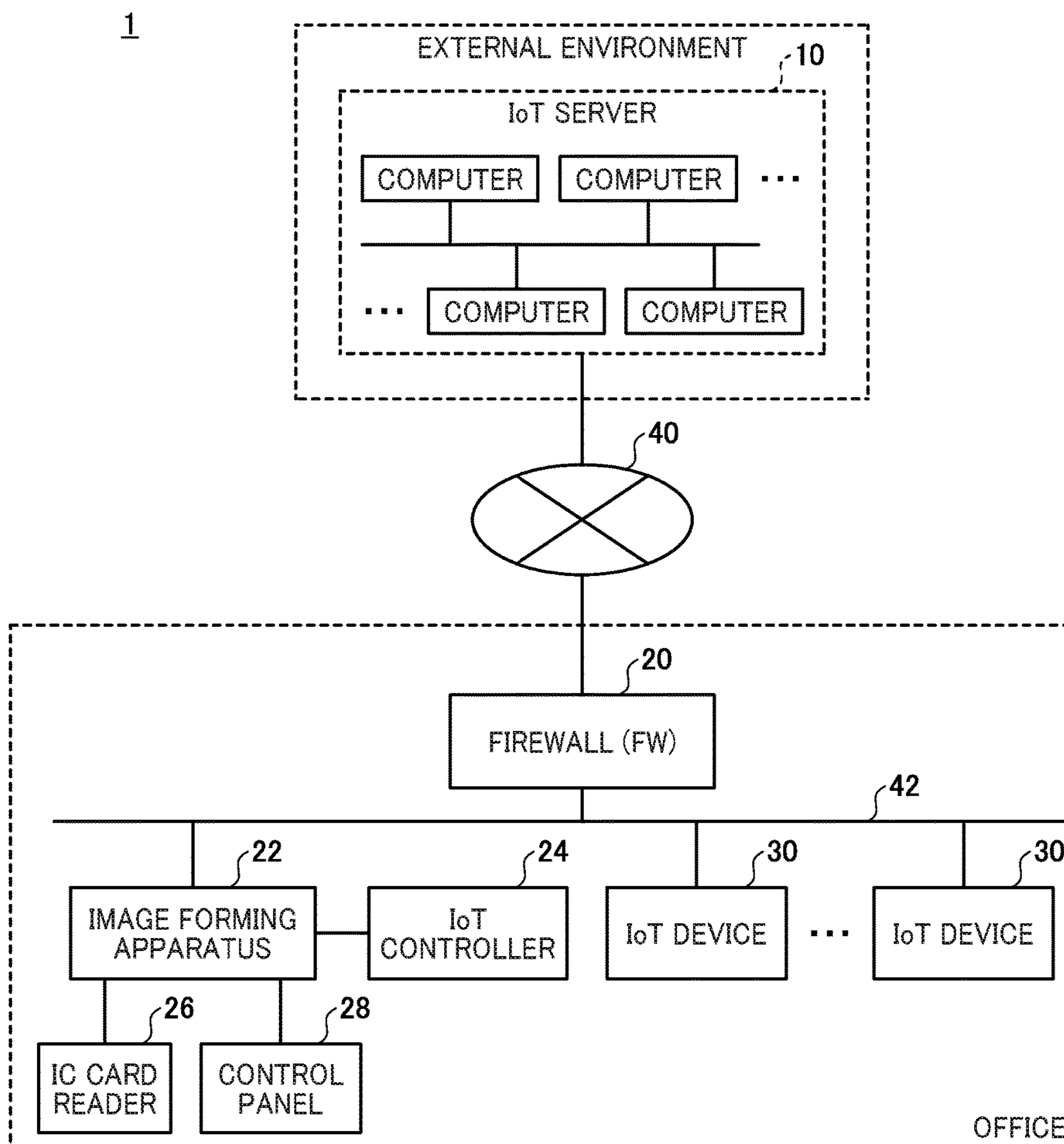


FIG. 16



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**INFORMATION PROCESSING APPARATUS  
FOR CONTROLLING CONTROL FLOW,  
INFORMATION PROCESSING SYSTEM FOR  
CONTROLLING CONTROL FLOW, AND  
METHOD FOR CONTROLLING DEVICE**

CROSS-REFERENCE TO RELATED  
APPLICATION

This patent application is based on and claims priority pursuant to 35 U.S.C. § 119(a) to Japanese Patent Application No. 2016-232532, filed on Nov. 30, 2016, the entire disclosure of which is hereby incorporated by reference herein.

BACKGROUND

Technical Field

The present disclosure relates to an information processing apparatus, a method for controlling a device, and an information processing system.

Description of the Related Art

Many devices including personal computers (PCs) are connected via a network nowadays. Further, not only the Internet communications but also network services called clouds, Web services, and Application Service Providers (ASP) are expanding.

The Internet of Things (IoT) is also known, which connects things including devices other than the personal computers to the Internet.

With application of the IoT communication network, not only computers and computer networks but also everyday things can be readable, recognizable, position-identifiable, addressable and controllable.

Further, machine-to-machine (M2M) communication is also known, in which machines connected to a communication network perform communication without intervention by persons and automatically execute appropriate machine control, etc.

SUMMARY

An information processing apparatus controls one or more processes of one or more devices belonging to a group based on data transmitted through a network from one or more devices belonging to the same group. The apparatus includes a memory and circuitry. The memory stores, on a group-by-group basis, policy data in which at least one of a user to whom at least one process of at least one device is permitted and a user to whom at least one process of at least one device is prohibited is set. The memory stores, on a group-by-group basis, a control flow that associates at least one condition with at least one process of at least one device that is to be executed when the at least one condition is satisfied. The circuitry makes the control flow effective, in a case in which the at least one process to be executed when the at least one condition is satisfied is permitted or is not prohibited to a user from whom a request for execution of the control flow is accepted, according to the policy data. The circuitry controls the at least one process of the at least one device according to the control flow that is made effective, on a group-by-group basis.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete appreciation of the embodiments and many of the attendant advantages and features thereof can be

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readily obtained and understood from the following detailed description with reference to the accompanying drawings, wherein:

FIG. 1 is a schematic view illustrating an example configuration of an information processing system according to an embodiment of the present disclosure;

FIG. 2 is a block diagram illustrating an example hardware configuration of a computer according to an embodiment of the present disclosure;

FIG. 3 is a block diagram illustrating an example hardware configuration of an image forming apparatus according to an embodiment of the present disclosure;

FIG. 4 is a block diagram illustrating an example hardware configuration of an IoT controller according to an embodiment of the present disclosure;

FIG. 5 is a block diagram illustrating a functional configuration of an IoT server according to an embodiment of the present disclosure;

FIG. 6 is a block diagram illustrating a functional configuration of a control panel and the image forming apparatus according to an embodiment of the present disclosure;

FIG. 7 is a block diagram illustrating a functional configuration of the IoT controller according to an embodiment of the present disclosure;

FIG. 8 is a block diagram illustrating a functional configuration of an IoT device according to an embodiment of the present disclosure;

FIG. 9 is a flowchart illustrating an operation of controlling IoT devices according to an embodiment of the present disclosure;

FIG. 10 is an illustration of an example of a control flow according to an embodiment of the present disclosure;

FIG. 11 is a flowchart illustrating an example of detailed processes performed at S12 of the flowchart of FIG. 9;

FIG. 12 is a flowchart illustrating an example of detailed processes performed at S13 of the flowchart of FIG. 9;

FIG. 13 is an illustration of an example of an IoT device control policy according to an embodiment of the present disclosure;

FIG. 14 is a flow chart illustrating another example of detailed processes performed at S13 of the flowchart of FIG. 9;

FIG. 15 illustrates an example of a control flow creation screen according to an embodiment of the present disclosure, and

FIG. 16 is a schematic view illustrating another example configuration of the information processing system according to an embodiment of the present disclosure.

The accompanying drawings are intended to depict embodiments of the present disclosure and should not be interpreted to limit the scope thereof. The accompanying drawings are not to be considered as drawn to scale unless explicitly noted.

DETAILED DESCRIPTION

In describing embodiments illustrated in the drawings, specific terminology is employed for the sake of clarity. However, the disclosure of this specification is not intended to be limited to the specific terminology so selected and it is to be understood that each specific element includes all technical equivalents that have a similar function, operate in a similar manner, and achieve a similar result.

As used herein, the singular forms “a”, “an”, and “the” are intended to include the multiple forms as well, unless the context clearly indicates otherwise.



Hereinafter, a description is given of several embodiments of the present disclosure with reference drawings.

[First Embodiment]

<System Configuration>

FIG. 1 is a schematic view illustrating an example configuration of an information processing system 1 according to a first embodiment. In an example of FIG. 1, the information processing system 1 includes one or more IoT (Internet of Things) devices 30 provided in an office. An image forming apparatus 22 of FIG. 1 is an example of an IoT device. An IoT controller 24, an integrated circuit (IC) card reader 26 and a control panel 28 are connected to the image forming apparatus 22.

The image forming apparatus 22 and the IoT devices 30 are connected to one another through an IoT network 42 such as a local area network (LAN). The IoT network 42 is connected to an IoT server 10 via a firewall 20 and a network 40 such as the Internet.

The IoT server 10 provides the IoT controller 24 with policy data and control flow data, described later. In addition, the IoT server 10 stores report data transmitted from the IoT controller 24 as described later. The image forming apparatus 22 is an example of an electronic apparatus that is highly likely to be installed in an office.

The image forming apparatus 22 may be a laser printer, a multifunction peripheral (multifunction printer), a projector, an electronic whiteboard, a videoconference apparatus, industrial or home equipment having a communication capability, and medical equipment having a communication capability.

The image forming apparatus 22 is capable of authenticating a user by using the IC card reader 26. Further, the image forming apparatus 22 is capable of displaying information to a user and accepting an instruction from a user, by using the control panel 28.

The IoT controller 24 communicates with the IoT server 10 and the IoT device 30 using the communication capability of the image forming apparatus 22. When the IoT controller 24 itself has a communication capability, such as when the IoT controller 24 includes a wireless communication module, the IoT controller 24 may communicate with the IoT server 10 and the IoT device 30 using its own communication capability. The IoT controller 24 may be provided in the form of an expansion board built in the image forming apparatus 22 or externally attached to the image forming apparatus 22. Alternatively, the IoT controller 24 may be in the form of a housing installed near the image forming apparatus 22.

The IoT controller 24 stores the policy data and the control flow data described later, which are provided from the IoT server 10. The control flow data provided from the IoT server 10 is data for collectively managing control of the IoT devices 30 throughout an entire organization such as a company.

In addition, the IoT controller 24 stores control flow data that is generated in the image forming apparatus 22 as described later. The control flow data generated in the image forming apparatus 22 is data for individually managing control of the IoT devices 30 on a group-by-group basis, for example, which is contained in the entire organization. The group is a concept indicating a unit constituting a part of the organization. The unit constituting a part of the organization may be indicated by a physical place such as an office or may be indicated by a relationship between organizations such as a department or division.

The IoT controller 24 executes a control flow selected by a user, to control operation by the IoT device 30. For

example, in response to receiving IoT device data from the IoT device 30, the IoT controller 24 determines whether the IoT device data meets conditions of the control flow being executed, and controls the IoT device 30 according to the control flow whose conditions are satisfied. It should be noted that the control flow being executed means that the control flow is effective (effective control flow). Thus, the IoT controller 24 is capable of controlling the IoT devices 30 that are located in the same office, as the IoT devices 30 belonging to a specific group, by the control flow.

The information processing system 1 may be applied to various devices that are connectable via the IoT network 42, in addition to the image forming apparatus 22. For the sake of explanatory convenience of the embodiments of the present disclosure, each of these devices is referred to, but not limited to, as an “IoT device”.

The “IoT device” in the present embodiment refers to a device connected to a network to implement the Internet of things (IoT). An IoT device is a device such as an electronic device and a sensor that includes a communication interface to which an address is designated, to enable the IoT device to communicate with other devices or servers using a network. In the present embodiment, examples of the IoT device include, but not limited to, a personal computer (PC), a mobile device such as a smartphone and a tablet, a wearable device, an air conditioner, a lighting device, an image forming apparatus such as a multifunction peripheral and a printer, a scanner, an electronic whiteboard, a projector, a sensor such as a temperature sensor and an acceleration sensor, a camera, a television, and a videoconference apparatus. In addition to the above, the IoT device includes various devices such as a refrigerator and a vending machine.

The mobile device as an example of the IoT device is a portable communication terminal such as a smartphone or a tablet that is communicable with the image forming apparatus 22 via a near-distance wireless communication network, for example.

The smartphone is typically a terminal that has multiple functions such as an imaging function implemented by a camera, or a function of displaying web information like a PC, in addition to a calling function as a mobile phone. The tablet is typically a tablet terminal that functions as a multifunction terminal in the same way as the smartphone does. The wearable device is typically a head-mounted device such as a smartglass, a device worn around a wrist such as a watch, a device worn on a chest such a neck strap. However, these are just examples, and alternatively, the wearable device may be attachable to an object that a user is carrying with him/her, such as a hat, a school bag, or a bag. In other words, in the present embodiment, “portable” includes both cases of being worn directly on a user’s body and being worn indirectly on a user’s body. The wearable device may be kept in a pocket of clothes or the like, or may be worn on a predetermined place (head, wrist, chest, etc.). Further, the wearable device may be held in a hand.

The IoT device 30 is a device such as an air conditioner, a lighting device, a multifunction peripheral, an electronic whiteboard, a projector, and a temperature sensor, provided in an office. The IoT device 30 performs registration to the IoT controller 24, and transmits IoT device data to the IoT controller 24. For example, in a case in which the IoT device 30 is a temperature sensor, the IoT device data is an output (temperature data) of the temperature sensor. In addition, in a case in which the IoT device 30 is an air conditioner, for example, the IoT device data includes ON/OFF of the power of the air conditioner and/or a temperature setting.



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The control panel **28** is implemented by a computer such as a tablet PC. Further, the control panel **28** is installed with an application having a screen displaying function, such as a web browser. The web browser is just an example of the application, and any other suitable application may be used provided that it has a function of displaying a control flow creation screen that enables creation of control flow data.

It should be noted that the configuration of the information processing system **1** illustrated in FIG. **1** is just an example, and one or more server apparatuses such as a proxy server and a gateway server may be interposed between the firewall **20** and the IoT server **10**.

The IoT device **30** includes the image forming apparatus **22** including or provided with the IoT controller **24**. The image forming apparatus **22** including or provided with the IoT controller **24** is referred to hereinafter as the “image forming apparatus **22** including the IoT controller **24**” in order to simplify the description. In each IoT device **30**, an IP address of the IoT server **10** (or the IoT device **30** including the IoT controller **24**) and a port number corresponding to a communication interface are set, to implement coordination with the IoT server **10** (or with the other IoT devices **30**).

Each IoT device **30** polls the IP address and port number via a communication interface periodically for example in order to inquire about the occurrence of any event. The inquiry includes, for example, identification information for identifying a communication destination such as a serial number. In a case in which the serial number designated in the inquiry is stored in the IoT server **10**, for example, the communication interface of the IoT server **10** transmits various data such as the policy data to the IoT device **30** corresponding to the serial number.

It should be noted that the serial number is just an example of identification information for identifying a communication destination. Any other suitable information may be used provided that the communication destination can be identified. The identification information for identifying a communication destination includes address information capable of identifying the IoT device **30** on the network and identification information assigned to the IoT device **30** by a service provider or an administrator.

In addition, the identification information for identifying a communication destination may be information changeable by the service provider or the administrator. For example, the identification information for identifying a communication destination stored in the IoT device **30** may be changeable through a direct operation to the IoT device **30** or an operation from a terminal that accesses the IoT device **30** via the network. Further, the identification information for identifying a communication destination may be stored in a storage medium **503a** such as a subscriber identifier module (SIM) card, from or to which the IoT device **30** reads out or write data via an interface. The identification information for identifying a communication destination assigned to the IoT device **30** may be changed by changing such storage medium.

Further, the IoT server **10** may manage the identification information such that the IoT device **30** having the IoT controller **24** and the IoT device **30** not having the IoT controller **24** are distinguishable from each other. For example, the IoT server **10** may store the identification information of the IoT device **30** having the IoT controller **24** and the identification information of the IoT device **30** not having the IoT controller **24** in separate tables. Further, the IoT server **10** may store the identification information of each IoT device **30** in association with flag information

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indicating whether or not the IoT device **30** has the IoT controller **24**. Furthermore, the IoT server **10** may change a way of assigning the identification information depending on whether or not the IoT device **30** has the IoT controller **24**.

In this case, the IoT server **10** may transmit various data such as the policy data only to the IoT device **30** including the IoT controller **24**. Further, only the IoT device **30** including the IoT controller **24** may request various data such as the policy data from the IoT server **10**. A detailed description is given later of a process by the IoT controller **24** of obtaining various data such as policy data from the IoT server **10**, with reference to FIG. **9**. Although, in the above, a description is given of communication between the IoT server **10** and the IoT device **30**, communication between the IoT device **30** including the IoT controller **24** and the other IoT devices **30** not including the IoT controller **24** may be performed in substantially the same manner. More specifically, the other IoT devices **30** not including the IoT controller **24** are able to poll the registered IoT controller **24**.

In a case in which no firewall **20** is interposed between the office as an example of a user environment and the IoT server **10** as an example of an external environment, the communication interface of the IoT server **10** may transmit various data such as the policy data to each IoT device **30**. In this case, device information stored in a policy data storage **55** may include an IP address, a port number, etc., of the IoT device **30**. The same applies to the communication between the IoT controller **24** and the IoT device **30** registered in the IoT controller **24**.

In addition, the IoT server **10** may be implemented by a distributed plurality of computers, as illustrated in FIG. **16**. FIG. **16** is a schematic view illustrating another example configuration of the information processing system **1** according to the present embodiment. In FIG. **16**, a plurality of computers cooperate to implement the IoT server **10** in the external environment.

Further, a part of functions of the IoT server **10** may be included in one or more other servers. In addition, the IoT devices **30** installed in the same office as illustrated in FIG. **1** is just an example, and the IoT devices **30** may be the IoT devices **30** installed on the same floor of a building or installed in the same room.

<Hardware Configuration>  
«Computer»

Each of the IoT server **10** and the control panel **28** of FIG. **1** is implemented by a computer having a hardware configuration as illustrated in FIG. **2**. FIG. **2** is a block diagram illustrating an example hardware configuration of the computer **500**.

As illustrated in FIG. **2**, the computer **500** includes an input device **501**, a display device **502**, an external interface **503**, a random access memory (RAM) **504**, a read only memory (ROM) **505**, a central processing unit (CPU) **506**, a communication interface **507**, and a hard disc drive (HDD) **508**, which are connected to one another via a bus B. It should be noted that the input device **501** and the display device **502** are not necessarily constantly connected to the bus B. In other words, the input device **501** and the display device **502** could be connected to the bus B as necessary when used.

The input device **501** includes a keyboard, a mouse, and/or a touch panel enabling a user to input various operation signals. The display device **502** includes a display on which results of processes by the computer **500** are displayed.



The communication interface **507** is an interface device to connect the computer **500** to various networks. The computer **500** communicates data via the communication interface **507**.

The HDD **508** is an example of a nonvolatile storage device that stores programs or data therein. Examples of the programs or data stored in the HDD **508** include an operating system (OS) for controlling an entire operation of the computer **500** and application software providing various functions on the OS. The computer **500** may include, instead of or in addition to the HDD **508**, a drive device such as a solid state drive (SSD) that uses a flash memory as a storage medium.

The external interface **503** is an interface device with an external device. Examples of the external device include the storage medium **503a**. The external interface **503** enables the computer **500** to read or write data from or to the storage medium **503a**. Examples of the storage medium **503a** include a flexible disc, a compact disc (CD), a digital versatile disc (DVD), a SD memory card, a universal serial bus (USB) memory, and a SIM card.

The ROM **505** is an example of a nonvolatile semiconductor memory (storage device), which holds programs or data even after the computer **500** is turned off as the power is not supplied. The ROM **505** stores programs and data such as a basic input output system (BIOS), which is executed when the computer **500** starts up, OS settings, and network settings. The RAM **504** is an example of a volatile semiconductor memory (storage device), which holds programs or data temporarily.

The CPU **506** reads programs or data from a storage device such as the ROM **505** and the HDD **508** onto the RAM **504**, and executes processes to implement the entire control of the computer **500** or functions of the computer **500**. The CPU **506** may be implemented by one processor or a plurality of processors.

The IoT server **10** and the control panel **28** implement processes as described later with the hardware configuration of the computer **500** illustrated in FIG. 2, for example.

«Image Forming Apparatus»

The image forming apparatus **22** of FIG. 1 is implemented by a hardware configuration as illustrated in FIG. 3, for example, in a case in which the image forming apparatus **22** is a multifunction peripheral. FIG. 3 is a block diagram illustrating an example hardware configuration of the image forming apparatus **22**. As illustrated in FIG. 3, the image forming apparatus **22** includes a controller **601**, an external interface **603**, a communication interface **604**, a printer **605**, and a scanner **606**.

The controller **601** includes a CPU **611**, a RAM **612**, a ROM **613**, a non-volatile random access memory (NVRAM) **614**, and an HDD **615**. The ROM **613** stores various programs and data. The RAM **612** stores programs and data temporarily. The NVRAM **614** stores setting information, etc., for example. The HDD **615** stores various programs and data.

The CPU **611** performs processes according to the programs, data, setting information, etc., read from the ROM **613**, the NVRAM **614**, the HDD **615**, etc., onto the RAM **612** to control an entire operation of the image forming apparatus **22** and implement functions of the image forming apparatus **22**.

The external interface **603** is an interface device with an external device. Examples of the external device include the IoT controller **24**, the IC card reader **26**, the control panel **28**, and a storage medium **603a**. The image forming apparatus **22** communicates with the IoT controller **24**, the IC card

reader **26**, and the control panel **28** via the external interface **603**. The control panel **28** includes an input device that accepts inputs from a user, and a display device that displays various types of information.

The external interface **603** further enables the image forming apparatus **22** to read or write data from or to the storage medium **603a**. Examples of the storage medium **603a** include an IC card, a flexible disc, a CD, a DVD, a SD memory card, a USB memory, and a SIM card.

The communication interface **604** is an interface device to connect the image forming apparatus **22** to the IoT network **42**. The image forming apparatus **22** communicates data via the communication interface **604**.

The printer **605** is a printing device that forms an image on a conveyed medium in accordance with print data. Examples of the conveyed medium include paper, coated paper, thick paper, overhead projector (OHP) transparencies, plastic films, pre-preg, and copper foil. The scanner **606** is a reading device that scans a document to obtain image data (electronic data). FIG. 3 illustrates a hardware configuration of a multifunction peripheral as an example of the image forming apparatus **22**. In a case in which the image forming apparatus **22** is a device or apparatus other than a multifunction peripheral, the printer **605** and/or the scanner **606** may be omitted. Further, the image forming apparatus **22** may include hardware components other than those illustrated in FIG. 3, such as a camera or a lamp light source.

«IoT controller»

The IoT controller **24** of FIG. 1 is implemented by, for example, a computer having a hardware configuration as illustrated in FIG. 4. FIG. 4 is a block diagram illustrating an example hardware configuration of the IoT controller **24**.

As illustrated in FIG. 4, the IoT controller **24** includes an external interface **701**, a RAM **702**, a CPU **703**, a ROM **704**, and an NVRAM **705**, which are connected to one another via a bus B. The NVRAM **705** is an example of a nonvolatile storage device that stores programs or data therein.

The external interface **701** is an interface device with an external device. Examples of the external device include the image forming apparatus **22** and a storage medium. The external interface **701** enables the IoT controller **24** to read or write data from or to a storage medium such as a flexible disc, a CD, a DVD, a SD memory card, a USB memory, and a SIM card.

The ROM **704** is an example of a nonvolatile semiconductor memory (storage device), which holds programs or data even after the IoT controller **24** is turned off as the power is not supplied. The ROM **704** stores programs or data executed when the IoT controller **24** is started up. The RAM **702** is an example of a volatile semiconductor memory (storage device), which holds programs or data temporarily. The CPU **703** reads programs or data from a storage device such as the ROM **704** and the NVRAM **705** onto the RAM **702**, and executes processes to implement the entire control of the IoT controller **24** or functions of the IoT controller **24**. The CPU **703** may be implemented by one processor or a plurality of processors. The IoT controller **24** implements various processes as described later with the hardware configuration as illustrated in FIG. 4, for example.

<Software Configuration>

A description is given hereinafter of a software configuration of the information processing system **1** according to the present embodiment. A description of elements or processes that are not relevant to the present embodiment is omitted below as appropriate.



«IoT server»

The IoT server **10** according to the present embodiment is implemented by processing blocks as illustrated in FIG. **5**, for example. FIG. **5** is a block diagram illustrating a functional configuration of the IoT server **10** according to the present embodiment.

The IoT server **10** of FIG. **5** implements a policy data provider **51**, a report data management unit **52**, a control flow provider **53**, a policy data storage **55**, a report data storage **56**, and a control flow storage **57** by executing a program.

The policy data provider **51** provides the IoT controller **24** with policy data described later. The policy data is stored in the policy data storage **55**. The policy data stored in the policy data storage **55** is used for determining whether or not a user is permitted to execute a control flow described later.

The report data management unit **52** receives report data from the IoT controller **24**, and stores the received report data in the report data storage **56**. The control flow provider **53** provides the IoT controller **24** with control flow data described later. The control flow data is stored in the control flow storage **57**. The control flow data stored in the control flow storage **57** is data for collectively managing control of the IoT devices **30** throughout an entire organization such as a company.

«Control Panel and Image Forming Apparatus»

Each of the control panel **28** and the image forming apparatus **22** according to the present embodiment is implemented by processing blocks as illustrated in FIG. **6**, for example. FIG. **6** is a block diagram illustrating a functional configuration of the control panel **28** and the image forming apparatus **22** according to the present embodiment.

The image forming apparatus **22** of FIG. **6** includes a communication unit **61**, a user management unit **62**, and a user information storage **63**. The communication unit **61** communicates data with the outside via the IoT network **42**. The user management unit **62** manages information stored in the user information storage **63**. For example, the user management unit **62** authenticates a user using information that is read out from a user's IC card by the IC card reader **26** and the user information stored in the user information storage **63**.

The control panel **28** implements a control flow creation acceptor **71** and a control flow execution requester **72** by executing a program. The control flow creation acceptor **71** displays the control flow creation screen, for example, to accept creation of an individual control flow to the IoT device **30** in an office from a user. Further, the control flow execution requester **72** requests the IoT controller **24** to execute a control flow selected by a user.

«IoT Controller»

The IoT controller **24** according to the present embodiment is implemented by processing blocks as illustrated in FIG. **7**, for example. FIG. **7** is a block diagram illustrating a functional configuration of the IoT controller **24** according to the present embodiment.

The IoT controller **24** of FIG. **7** implements a policy data management unit **81**, an IoT device registration unit **82**, a control flow management unit **83**, a control flow execution unit **84**, an event control unit **85**, and a report control unit **86**, by executing a program. Further, the IoT controller **24** implements an IoT device control policy storage **91**, a data access policy storage **92**, an IoT device data storage **93**, and a control flow storage **94**.

The policy data management unit **81** stores an IoT device control policy included in the policy data provided from the IoT server **10** in the IoT device control policy storage **91**,

and manages the stored control policy. Further, the policy data management unit **81** stores a data access policy included in the policy data provided from the IoT server **10** in the data access policy storage **92**, and manages the stored access policy.

It should be noted that the larger the number of IoT devices **30** to be handled, the larger the amount of the policy data. To address this issue, the policy data management unit **81** performs an update process of deleting the policy data that is no more required, to save a memory capacity. The policy data may be deleted in the following ways.

As one way of deleting the policy data, once the IoT controller **24** receives, from the IoT server **10**, information identifying given policy data and a notification indicating that the given policy data is not more required, the policy data management unit **81** deletes the given policy data. Before deleting the policy data, the policy data management unit **81** may transmit log information including information indicating which policy data is to be deleted and a serial number of the IoT controller **24** itself to the IoT server **10**. This enables the IoT server **10** to recognize which IoT controller **24** stores which policy data.

As another way of deleting the policy data, policy data item is provided with an expiration in advance, and the IoT controller **24** determines whether or not a target policy data has been expired. When the determination result indicates that the target policy data has been expired, the policy data management unit **81** deletes the policy data, in substantially the same manner as the above way. In the similar manner to the above, the policy data management unit **81** may transmit the log information to the IoT server **10** before deleting the policy data.

In another example, the policy data management unit **81** determines whether the IoT device **30** related to the policy data received from the IoT server **10** is registered in the IoT device data storage **93** of the IoT controller **24**. When the determination result indicates that the IoT device **30** is not registered, the policy data management unit **81** may notify the IoT server **10** that the IoT device **30** is not registered, and delete the policy data.

In this case, when the IoT device **30** is newly registered in the IoT device data storage **93**, the policy data management unit **81** inquires of the IoT server **10** about whether policy data that is not stored in the IoT controller **24** and relates to the newly registered IoT device **30** is stored in the IoT server **10**, from the image forming apparatus **22**.

When the IoT server **10** determines that the policy data that matches the inquired condition is stored in the IoT server **10**, the IoT server **10** transmits the corresponding policy data to the image forming apparatus **22** to enable the IoT controller **24** to update the policy data stored therein. A detailed description is given later of a process of newly registering the IoT device **30**, with reference to FIG. **11**.

The IoT device registration unit **82** registers the IoT devices **30** located in the same office in the IoT device data storage **93**, as the IoT devices **30** belonging to a specific group. In the IoT device data storage **93**, the IoT device data of the IoT devices **30** belonging to the specific group is stored.

The control flow management unit **83** stores the control flow data provided from the IoT server **10** in the control flow storage **94**, and manages the stored control flow data. Further, the control flow management unit **83** stores data of the control flow created by a user on the control panel **28** as control flow data in the control flow storage **94**, and manages the stored control flow data.



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The control flow execution unit **84** performs processes relating to execution of the control flow. In a case in which a user who requested execution of a given control flow is not prohibited for a process of the given control flow, the control flow execution unit **84** starts execution of the requested control flow. The event control unit **85** detects events including a request for execution of a control flow from the control panel **28**, the reception of IoT device data from the IoT device **30**, the reading-out of information from an IC card. Further, the event control unit **85** notifies the control flow management unit **83** and the control flow execution unit **84** of the detected events.

The report control unit **86** transmits the IoT device data stored in the IoT device data storage **93** as report data to the IoT server **10** according to the data access policy stored in the data access policy storage **92**.

«IoT Device»

The IoT device **30** according to the present embodiment is implemented by processing blocks as illustrated in FIG. **8**, for example. FIG. **8** is a block diagram illustrating a functional configuration of the IoT device **30** according to the present embodiment.

The IoT device **30** of FIG. **8** includes an IoT device registration requester **101** and an IoT device data transmitter **102**. The IoT device registration requester **101** requests the IoT controller **24** to register the IoT device **30** itself in the IoT controller **24**. The IoT device data transmitter **102** transmits IoT device data to the IoT controller **24** that registered the IoT device **30** according to the request from the IoT device registration requester **101**.

<Operation>

«IoT Device Control»

The information processing system **1** according to the present embodiment performs an operation for controlling the IoT devices **30** as illustrated in FIG. **9**. FIG. **9** is a flowchart illustrating an operation of controlling the IoT devices **30** according to the present embodiment.

At S11, the policy data management unit **81** of the IoT controller **24** accesses the policy data provider **51** of the IoT server **10**. The policy data management unit **81** designates identification information (ID) of an organization such as a company or a building that collectively manages control of the IoT devices **30**, to receive policy data associated with the ID from the policy data provider **51**. It should be noted that the IoT server **10** may store the policy data of an organization in association with the identification information of the IoT controller **24** instead of the organization's identification information (ID). In this case, the IoT server **10** may receive the identification information of the IoT controller **24** and obtain the policy data associated with the received identification information. Accordingly, the policy data provider **51** provides the obtained policy data to the IoT controller **24**. In addition, the IoT server **10** may store the identification information (ID) of an organization in association with the identification information of the IoT controller **24**. In this case, the IoT server **10** identifies the identification information (ID) of organization based on the received identification information of the IoT controller **24**. The IoT server **10** obtains policy data based on the identified identification information (ID) of organization, and provides the obtained policy data to the IoT controller **24**.

The policy data management unit **81** sets the IoT device control policy and the data access policy included in the received policy data. Specifically, the policy data management unit **81** stores the IoT device control policy in the IoT device control policy storage **91** to set the IoT device control policy. In addition, the policy data management unit **81**

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stores the data access policy in the data access policy storage **92** to set the data access policy.

Further, the control flow management unit **83** of the IoT controller **24** accesses the control flow provider **53** of the IoT server **10**. The control flow management unit **83** designates identification information (ID) of an organization such as a company or a building that collectively manages control of the IoT devices **30**, to receive control flow data associated with the ID from the control flow provider **53**. The control flow management unit **83** stores the received control flow data in the control flow storage **94** to perform setting.

In the similar manner to the policy data, the IoT server **10** may store the control flow data of an organization in association with the identification information of IoT controller **24** instead of the organization's identification information (ID). In this case, the IoT server **10** may receive the identification information of the IoT controller **24** and obtain the control flow data associated with the received identification information. Accordingly, the control flow provider **53** provides the obtained control flow data to the IoT controller **24**. In addition, the IoT server **10** may store the identification information (ID) of an organization in association with the identification information of the IoT controller **24**. In this case, the IoT server **10** identifies the identification information (ID) of organization based on the received identification information of the IoT controller **24**. Accordingly, the IoT server **10** obtains control flow data based on the identified identification information (ID) of organization, and provides the obtained control flow data to the IoT controller **24**.

With the process of S11, the IoT controller **24** is able to obtain the policy data and the control flow data associated with an organization that collectively manages control of the IoT devices **30** from the IoT server **10**, and set the obtained data.

At S12, the IoT device registration unit **82** of the IoT controller **24** searches for the IoT devices **30** installed in the same office. The IoT device registration requester **101** of the searched IoT devices **30** requests the IoT device registration unit **82** of the IoT controller **24** to register the IoT device **30** itself. The IoT device registration unit **82** registers the IoT devices **30** from which the request for IoT device registration is received in the IoT device data storage **93** as the IoT devices **30** belonging to a specific group.

In addition, the IoT device data transmitter **102** of the IoT devices **30** that sent the request for IoT device registration starts transmission of IoT device data to the IoT controller **24** that registered the IoT devices **30**. The event control unit **85** stores the IoT device data received from the IoT devices **30** in the IoT device data storage **93**.

At S13, the control flow execution unit **84** of the IoT controller **24** receives selection of a control flow to be executed from a user operating the image forming apparatus **22**. The control flow execution unit **84** refers to the IoT device control policy to determine whether the user who selected the control flow is a user to whom a process of the control flow is permitted.

In a case in which the process of the selected control flow is permitted to the user who selected the control flow, the control flow execution unit **84** starts execution of the control flow as illustrated in FIG. **10**, for example. FIG. **10** illustrates an example of the control flow. The control flow in FIG. **10** has a control flow name, conditions, and processes as items. The control flow name is an example of identification information that enables a user to identify a control flow. The processes are various processes for controlling the



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IoT device **30**. The conditions are various conditions for performing the processes of a control flow.

For example, the control flow of FIG. **10** is a control flow for controlling an air conditioner, which is an example of the IoT device **30**. The control flow of FIG. **10** indicates that when a condition of “8 o’clock to 20 o’clock on weekdays” and a condition of “temperature sensor, 28° C. or higher” are both satisfied, the processes of “turning on the air conditioner” and “setting a temperature to 25° C.” are to be performed. Further, the control flow of FIG. **10** indicates that when a condition of “8 o’clock to 20 o’clock on weekdays” and a condition of “temperature sensor, 22° C. or lower” are both satisfied, the processes of “turning on the air conditioner” and “setting a temperature to 25° C.” are to be performed.

Once the execution of control flow is started, the control flow execution unit **84** repeats the processes from S**14** to S**16** to detect a control flow that matches the conditions, until a user instructs the end of execution of the control flow. In a case in which a control flow that matches the conditions is detected, an operation proceeds to S**15**. At S**15**, the control flow execution unit **84** controls the IoT device **30** according to the control flow that matches the conditions.

«Processes of S**12**»

FIG. **11** is a flowchart illustrating detailed processes performed at S**12**. At S**21**, the IoT device registration unit **82** of the IoT controller **24** searches for the IoT devices **30** located in the same office. For example, the IoT device registration unit **82** performs broadcasting to search for the IoT devices **30** in an office.

At S**22**, the IoT device registration requester **101** of each of the searched IoT devices **30** (e.g., the IoT devices **30** that received the broadcast) requests the IoT device registration unit **82** of the IoT controller **24** to register the IoT device **30** itself. This request for the registration of IoT device contains device information of the IoT device **30** and information indicating available functions (processes)

The device information of the IoT device **30** includes the above-described identification information for identifying communication destination. The IoT devices **30** are distinguished from each other by using the identification information. Further, the device information includes address information such as an IP address for identifying the IoT device **30** on a network. Data are transmitted to the IoT device **30** by using the address information. It should be noted that the identification information for identifying a communication destination may be the address information. The IoT device registration unit **82** of the IoT controller **24** registers the device information and information of available functions of the IoT devices **30** from which the request for IoT device registration is received in the IoT device data storage **93** as the IoT devices **30** belonging to a specific group.

At S**23**, the IoT device data transmitter **102** of the IoT devices **30** that sent the request for IoT device registration starts transmission of IoT device data to the IoT controller **24** that registered the IoT devices **30**. The event control unit **85** of the IoT controller **24** starts receiving the IoT device data from the IoT devices **30** and storing the received IoT device data in the IoT device data storage **93**.

«Processes of S**13**»

FIG. **12** is a flowchart illustrating an example of detailed processes performed at S**13**. At S**31**, the control flow execution unit **84** of the IoT controller **24** authenticates a user operating the control panel **28** and identifies the user information of the user operating the control panel **28**. At S**32**, the

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control flow execution unit **84** accepts selection of the control flow to be executed from the user operating the image forming apparatus **22**.

At S**33**, the control flow execution unit **84** refers to the control flow of FIG. **10** to extract processes of the control flow selected by the user. The processes of the control flow extracted at S**33** are processes of the IoT device **30** required for executing the control flow selected by the user.

At S**34**, the control flow execution unit **84** identifies a role included in the user information of the user operating the image forming apparatus **22**. Further, the control flow execution unit **84** refers to the IoT device control policy as illustrated in FIG. **13** to identify processes that are permitted and processes that are prohibited corresponding to the role of the user operating the image forming apparatus **22**.

The control flow execution unit **84** compares the processes permitted and prohibited corresponding to the role of the user operating the image forming apparatus **22** with the processes of the IoT device **30** required for executing the control flow selected by the user. Based on the comparison result, the control flow execution unit **84** determines whether or not the user operating the image forming apparatus **22** is prohibited for the processes of the IoT device **30** required for executing the control flow selected by the user.

In other words, the control flow execution unit **84** determines, based on the IoT device control policy as illustrated in FIG. **13**, whether the user who selected the control flow is a user to whom the processes of the selected control flow are permitted.

When the control flow execution unit **84** determines that the processes required for executing the selected control flow are permitted to the user operating the image forming apparatus **22** (S**35**: YES), the operation proceeds to S**36**. At S**36**, the control flow execution unit **84** starts execution of the control flow that is selected by the user at S**32**. When the control flow execution unit **84** determines that the processes required for executing the selected control flow are prohibited to the user operating the image forming apparatus **22** (S**35**: NO), the operation proceeds to S**37**. At S**37**, the control flow execution unit **84** instructs the control panel **28** to display an error message, for example.

In other words, in a case in which a user who selected a given control flow is a user to whom the processes of the selected control flow are permitted, the control flow execution unit **84** starts execution of the control flow selected by the user. By contrast, in a case in which a user who selected a given control flow is a user to whom the processes of the selected control flow are prohibited, the control flow execution unit **84** does not start execution of the control flow selected by the user.

In an example of the IoT device control policy illustrated in FIG. **13**, “power on/off” and “temperature setting”, which are processes of an air conditioner as the IoT devices **30**, are permitted to a user whose role is an “administrative user”. Further, “power on/off and “temperature setting”, which are processes of an air conditioner as the IoT device **30**, are prohibited to a user whose role is a “general user”.

Although in the IoT device control policy illustrated in FIG. **13**, both of the users to whom the processes are permitted and prohibited are set, only a user to whom one or more processes are permitted may be set in the IoT device control policy. In another example, only a user to whom one or more processes are prohibited may be set in the IoT device control policy.

In a case in which the role of a user who selected the control flow of FIG. **10** at S**32** is the “administrative user”, the control flow execution unit **84** determines that the user



is a user to whom “power on/off” and “temperature” are permitted. Accordingly, the control flow execution unit **84** starts execution of the control flow of FIG. **10**. By contrast, in a case in which the role of a user who selected the control flow of FIG. **10** at S**32** is the “general user”, the control flow execution unit **84** determines that the user is a user to whom “power on/off” and “temperature” are prohibited. Accordingly, the control flow execution unit **84** requests the control panel **28** to display an error notification without starting execution of the control flow of FIG. **10**.

With the operation of FIG. **12**, the control of IoT devices **30** that an organization such as a company possesses is collectively managed throughout the entire organization based on the control flows of the IoT devices **30** provided by the IoT server **10**. Further, with the operation of FIG. **12**, by connecting the image forming apparatus **22** that is located one by one in one room to the IoT controller **24**, an authorized user is able to select a control flow that is to be executed individually on a specific group-by-group basis, such as an office-by-office basis or a room-by-room basis.

Therefore, for example, in a case in which the control of air conditioners is collectively managed within a company or in a building, an operation is possible in which an authorized user selects a control flow of the IoT device **30** in a certain office from the control flows provided from the IoT server **10**. By enabling such an authorized user to select the control flow, the operation of FIG. **12** ensures security.

The process of FIG. **13** may be also implemented by an operation as illustrated in FIG. **14**. FIG. **14** is a flowchart illustrating another example of variation of the detailed processes performed at S**13**. At S**41**, the control flow execution unit **84** of the IoT controller **24** authenticates a user operating the control panel **28** and identifies the user information of the user operating the control panel **28**.

At S**42**, the control flow creation acceptor **71** of the control panel **28** displays a control flow creation screen as illustrated in FIG. **15**, for example, to accept creation of a control flow from a user. FIG. **15** illustrates an example of the control flow creation screen. The control flow creation screen of FIG. **15** is an example screen on which a control flow is generated that controls an air conditioner as one of the IoT devices **30** based on data (temperature data) that is output from a temperature sensor as another one of the IoT devices **30**. For example, Node-RED, which is an example of application development tool, can be used for the control flow creation screen.

For example, an example of the control flow created by the user at S**42** is the control flow illustrated in FIG. **10**. A control logic created on the control flow creation screen corresponds to data indicating the conditions and processes of the control flow of FIG. **10**. In addition, the temperature sensor and the air conditioner displayed on the control flow creation screen of FIG. **15** can be selected from the IoT devices **30** registered at S**12** of FIG. **9**. In addition, the control logic displayed on the control flow creation screen of FIG. **15** can be created based on the functions of the IoT device **30** that are grasped by executing S**12** of FIG. **9**.

It should be noted that the processes up to the creation of the control flow on the control flow creation screen in FIG. **15** may be permitted to a user who is not authenticated at S**41**. Further, the creation of the control flow on the control flow creation screen may be performed from, in addition to the control panel **28**, a user terminal that is communicable with the IoT controller **24**.

At S**43**, the control flow execution unit **84** receives, from a user, a request for executing the control flow created by a user at S**42**. At S**44**, the control flow execution unit **84**

extracts processes of the control flow created by the user. The processes of the control flow extracted at S**44** are processes of the IoT device **30** required for executing the control flow created by the user.

At S**45**, the control flow execution unit **84** identifies a role included in the user information of the user operating the image forming apparatus **22**. Further, the control flow execution unit **84** refers to the IoT device control policy as illustrated in FIG. **13** to identify processes that are permitted and processes that are prohibited corresponding to the role of the user operating the image forming apparatus **22**.

The control flow execution unit **84** compares the processes permitted and processes prohibited corresponding to the role of the user operating the image forming apparatus **22** with the processes of the IoT device **30** required for executing the control flow created by the user. Based on the comparison result, the control flow execution unit **84** determines whether or not the user operating the image forming apparatus **22** is prohibited for the processes of the IoT device **30** required for executing the control flow created by the user.

In other words, the control flow execution unit **84** determines, based on the IoT device control policy as illustrated in FIG. **13**, whether the user who created the control flow is a user to whom the processes of the created control flow are permitted.

When the control flow execution unit **84** determines that the processes required for executing the created control flow are permitted to the user operating the image forming apparatus **22** (S**46**: YES), the operation proceeds to S**47**. At S**47**, the control flow execution unit **84** starts an update of the control flows stored in the control flow storage **94** to reflect the control flow created by the user at S**42**, and starts execution of the created control flow. When the control flow execution unit **84** determines that the processes required for executing the created control flow are prohibited to the user operating the image forming apparatus **22** (S**46**: NO), the operation proceeds to S**48**. At S**48**, the control flow execution unit **84** instructs the control panel **28** to display an error message, for example.

In other words, in a case in which a user who created a new control flow is a user to whom the processes of the created control flow are permitted, the control flow execution unit **84** starts the reflection and execution of the control flow created by the user. By contrast, in a case in which a user who created a new control flow is a user to whom the processes of the created control flow are prohibited, the control flow execution unit **84** does not start the reflection and execution of the control flow created by the user.

With the operation of FIG. **14**, an authorized user is able to create a control flow individually on a specific group-by-group basis, such as an office-by-office basis, and instruct execution of the created control flow. For example, an operation is possible in which a control flow is generated and executed by a room-by-room basis, by connecting the IoT controller **24** to the image forming apparatus **22** that is located one by one in one room.

A description is given hereinafter of an example in which the information processing system **1** according to the present embodiment is executing the control flow as illustrated in FIG. **10** that controls an air conditioner as the IoT device **30** to prevent temperature from being lower than a predetermined degree throughout a building. Further, in this example, it is assumed that the operation of one or more IoT devices **30** installed in an office is controlled by other one or more IoT devices **30** in the office.



In this example, there may be a case in which one wants to execute a control flow that controls an air conditioner as one of the IoT devices **30** in cooperation with a temperature sensor as another one the IoT devices **30**, only in an office in which an employee works on a holiday. However, if anyone can freely select and execute a desired control flow, problems in security and safety may occur.

The information processing system **1** according to the present embodiment enables to change flexibly the control flow in units of the IoT devices **30** belonging to a specific group, while ensuring security and safety.

In a case in which the processes of the IoT device **30** required for executing a control flow are partly prohibited to a user operating the image forming apparatus **22**, the control flow execution unit **84** may perform operation as follows. For example, the control flow execution unit **84** may present a control flow from which the prohibited process is excluded and the content of the excluded process to a user, thereby accepting selection as to whether the presented control flow is to be executed from the user.

When the accepted selection indicates that the control flow is to be executed, the control flow execution unit **84** does not execute the control flow from which the prohibited process is excluded. By contrast, when the accepted selection indicates that the control flow is not to be executed, the control flow execution unit **84** starts the reflection and execution of the control flow from which the prohibited process is excluded.

For example, it is assumed that the control flows includes a first process of “notifying a user terminal that conditions are satisfied” and a second process of “turning on an air conditioner”, and the first process is permitted to a general user and the second process is prohibited to a general user. In the policy, the process of “notifying a user terminal that conditions are satisfied” is not prohibited. Accordingly, a control flow of the process of “notifying a user terminal that conditions are satisfied” may be executed by a general user.

In this case, the control flow execution unit **84** may present to a user information indicating that although the turning on of an air conditioner is prohibited, sending a notification to a user when the conditions of a temperature sensor are satisfied is permitted, thereby enabling the user to select whether to execute this control flow. Further, the control flow execution unit **84** may reflect and execute the control flow from which the prohibited process is excluded, without presenting the information as described above.

#### <Variations>

In the first embodiment, a description is given of an example in which operation of an air conditioner as one example of the IoT device **30** is controlled in cooperation with a temperature sensor as another example of the IoT device **30** according to the control flow. However, this is just one example of the control flow.

In another example, an air conditioner as one example of the IoT device **30** is controlled in cooperation with a lighting device as another example of the IoT device **30** according to a control flow. For example, in response to turning on the power of the lighting device, the air conditioner is turned on. In still another example, a lighting device and an air conditioner, both of which are examples of the IoT device **30**, are controlled in cooperation with a projector as another example of the IoT device **30**. For example, in response to turning on the power of the projector, the power of the lighting device is turned on, and the set temperature of the air conditioner is lowered.

In still another example, in response to turning on the power of the projector as one example of the IoT device **30**,

the brightness of the lighting device as another example of the IoT device **30** is lowered, and the set temperature of the air conditioner as another example of the IoT device **30** is lowered, according to the control flow.

According to embodiments of the present disclosure, a control flow is defined in units of devices belonging to a group.

The above-described embodiments are illustrative and do not limit the present disclosure. Thus, numerous additional modifications and variations are possible in light of the above teachings. For example, elements and/or features of different illustrative embodiments may be combined with each other and/or substituted for each other within the scope of the present disclosure.

Any one of the above-described operations may be performed in various other ways, for example, in an order different from the one described above.

The information processing system I described in the above embodiments is just an example, and there may be various system configurations depending on applications or purposes.

The present disclosure can be implemented in any convenient form, for example using dedicated hardware, or a mixture of dedicated hardware and software. The present disclosure may be implemented as computer software implemented by one or more networked processing apparatuses. The network can include any conventional terrestrial or wireless communications network, such as the Internet. The processing apparatuses can comprise any suitably programmed apparatuses such as a general-purpose computer, personal digital assistant, mobile telephone (such as a WAP or 3G-compliant phone) and so on. Since the present disclosure can be implemented as software, each and every aspect of the present disclosure thus encompasses computer software implementable on a programmable device. The computer software can be provided to the programmable device using any storage medium for storing processor readable code such as a floppy disk, hard disk, CD ROM, magnetic tape device or solid state memory device.

The hardware platform includes any desired kind of hardware resources including, for example, a central processing unit (CPU), a random access memory (RAM), and a hard disk drive (HDD). The CPU may be implemented by any desired kind of any desired number of processor. The CPU may be implemented by one or more processors. The RAM may be implemented by any desired kind of volatile or non-volatile memory. The HDD may be implemented by any desired kind of non-volatile memory capable of storing a large amount of data. The hardware resources may additionally include an input device, an output device, or a network device, depending on the type of the apparatus. Alternatively, the HDD may be provided outside of the apparatus as long as the HDD is accessible. In this example, the CPU, such as a cache memory of the CPU, and the RAM may function as a physical memory or a primary memory of the apparatus, while the HDD may function as a secondary memory of the apparatus.

Each of the functions of the described embodiments may be implemented by one or more processing circuits or circuitry. Processing circuitry includes a programmed processor, as a processor includes circuitry. A processing circuit also includes devices such as an application specific integrated circuit (ASIC), DSP (digital signal processor), FPGA (field programmable gate array) and conventional circuit components arranged to perform the recited functions.



What is claimed is:

1. An information processing apparatus for controlling one or more processes of one or more devices belonging to a group based on data transmitted through a network from one or more devices belonging to the same group, the apparatus comprising:
  - a memory to store,
    - on a group-by-group basis, policy data in which at least one of a first user to whom at least one process of at least one device is permitted and a second user to whom at least one process of at least one device is prohibited is set, and
    - on a group-by-group basis, a control flow that associates at least one condition with at least one process of at least one device to be executed when the at least one condition is satisfied; and
  - circuitry configured to,
    - make the control flow effective when the at least one condition is satisfied by determining whether the at least one process associated with the at least one condition is permitted or is not prohibited to a user from whom a request for execution of the control flow is accepted, according the policy data, the user from whom the request for execution of the control flow is accepted being the first user or the second user, and
    - control the at least one process of the at least one device according to the control flow that is made effective, on a group-by-group basis.
2. The information processing apparatus of claim 1, wherein
  - when the request for executing is a request for executing a created control flow that has been created by the user from whom the request for execution of the control flow is accepted, the circuitry updates data of the control flow stored in the memory to reflect the created control flow, in a case in which, according the policy data, one or more processes of the created control flow are permitted or are not prohibited to the user from whom the request for executing the created control flow is accepted.
3. The information processing apparatus of claim 2, wherein
  - the circuitry is configured to obtain a control flow of an organization containing the group from a server apparatus via the network, and stores the obtained control flow in the memory.
4. The information processing apparatus of claim 1, wherein
  - the circuitry is configured to:
    - search for the one or more devices belonging to the group, connected to the information processing apparatus via the network,
    - register the one or more devices that are searched in the memory; and
    - start receiving data from the one or more devices that are registered.
5. The information processing apparatus of claim 1, wherein
  - the circuitry is configured to obtain the policy data from a server apparatus via the network and store the obtained policy data in the memory.
6. The information processing apparatus of claim 1, wherein
  - the information processing apparatus is connected to the network via a given device of the one or more devices, and

the circuitry is configured to perform data communication via the network using a communication function of the given device.

7. The information processing apparatus of claim 6, wherein
  - the circuitry is configured to accept the request for executing the control flow using a control panel connected to the given device.
8. The information processing apparatus of claim 6, wherein
  - the circuitry is configured to authenticate the user from whom the request for execution of the control flow is accepted using an authentication apparatus connected to the given device.
9. The information processing apparatus of claim 6, wherein
  - the circuitry is configured to accept a request for creating a control flow from the user from whom the request for execution of the control flow is accepted using a control panel connected to the given device.
10. The information processing apparatus of claim 6, wherein
  - the circuitry is configured to accept a request for creating a control flow from a user operating a user terminal connected via the network.
11. The information processing apparatus of claim 1, wherein
  - in a case in which a part of the one or more processes of the control flow of which execution is requested is prohibited to the user from whom the request for execution of the control flow is accepted according to the policy data, the circuitry makes the control flow from which the part that is prohibited is excluded effective, and
  - the circuitry is configured to control the at least one process of the at least one device based on the control flow that is made effective.
12. The information processing apparatus of claim 1, wherein the one or more devices includes an image forming apparatus and at least one other device.
13. The information processing apparatus of claim 12, wherein the circuitry is configured to cause the information processing apparatus to communicate with the at least one other device using the image forming apparatus.
14. A method for controlling one or more processes of one or more devices belonging to a group based on data transmitted through a network from one or more devices belonging to the same group, performed by an information processing apparatus, the method comprising:
  - storing in a memory, on a group-by-group basis, policy data in which at least one of a first user to whom at least one process of at least one device is permitted and a second user to whom at least one process of at least one device is prohibited is set;
  - storing in the memory, on a group-by-group basis, a control flow that associates at least one condition with at least one process of at least one device that is to be executed when the at least one condition is satisfied;
  - making the control flow effective when the at least one condition is satisfied by determining whether that at least one process associated with the at least one condition is permitted or is not prohibited to a user from whom a request for execution of the control flow is accepted, according the policy data, the user from whom the request for execution of the control flow is accepted being the first user or the second user; and

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controlling the at least one process of the at least one device according to the control flow that is made effective, on a group-by-group basis.

15. An information processing system including one or more devices belonging to a group and an information processing apparatus for controlling one or more processes of the one or more devices, the system comprising:

a memory to store,

on a group-by-group basis, policy data in which at least one of a first user to whom at least one process of at least one device is permitted and a second user to whom at least one process of at least one device is prohibited is set, and

on a group-by-group basis, a control flow that associates at least one condition with at least one process of at least one device to be executed when the at least one condition is satisfied; and

one or more processors to,

make the control flow effective when the at least one condition is satisfied by determining whether the at least one process associated with the at least one condition is permitted or is not prohibited to a user from whom a request for execution of the control flow is accepted, according the policy data, the user

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from whom the request for execution of the control flow is accepted being the first user or the second user, and

control the at least one process of the at least one device according to the control flow that is made effective, on a group-by-group basis.

16. The information processing system of claim 15, wherein the one or more devices includes an image forming apparatus and at least one other device.

17. The information processing system of claim 16, further comprising:

a control device including the memory and the one or more processors, wherein the control device is configured to communicate with the at least one other device using the image forming apparatus.

18. The information processing system of claim 17, wherein the at least one other device is an air conditioner, a lighting device, a multifunction peripheral, an electronic whiteboard, a projector, a projection or any combination thereof.

19. The information processing system of claim 15, wherein the group-by-group basis is a room-by-room basis.

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